L O T H L O R I E N Lines

M and Y
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A Waybill Based Operating "SYSTEM"

A few years ago, after starting to operate on a other layouts, I started to get the empty feeling that I never had enough information about what I was doing. Yes, I was "running trains". But when a car card was for boxcar MEC 5582 and I had to look at each car in the train because I didn't yet have a clue that MEC boxcars might be green, I had that empty feeling. When I carefully noted that Floresta was to the east, or that Cresson was to the west, I still got that empty feeling when I had a car that was routed to Pitcairn. I never heard of Pitcairn -- which way should I send it? How about this car for the D&RGW interchange? Where should it go? What about this car for Baltimore? Should it go east to Tamaqua to go south, or should it go west to Shamokin to go south?

When I started thinking about my own railroad, I decided that I wanted to model fun stuff, but NOT THE INEFFICIENCIES! I wanted to have rules to follow because I understood them and because they contributed to my operation, NOT because someone dictated to me, "Well they always did it this way on the prototype." Why did they do it that way? Will it help me in my model of the railroad? If not, then I won't do it. I don't care what the prototype did if it's going to spoil my fun. It's my railroad. I'll do it my way.

When I started to consider what paperwork I needed for my own railroad, I decided that I wanted paperwork that would contribute to my operation, not paperwork for the sake of paperwork. I also wanted to eliminate those previously experienced empty feelings for other operators, especially any new folks. I wanted a system that would be complete, but simple to understand. Yes, a SYSTEM. With 25 years of experience designing computer based business systems, I knew that the clearance forms alone, or that the car cards alone or that the waybills alone were not a solution. There has to be an integrated system where each of the parts serves its own purpose, but also complements the other parts. It did not matter to me how complex the underlying mechanisms of the system were so long as they were simple at the user interface. In other words, if I did the knuckle work before hand, then the train crew could just look at the result and get an immediate picture of what was to happen (if they would only take the effort to read a few words on the paperwork made available to them).

After a bit more observation, I realized that some operators think that they are too busy running their train to actually bother to read anything, so I thought that color coding might be useful. Then, even without reading all the gory details, any crew member could just glance at the paperwork and be able to immediately tell at least in which direction a piece of equipment was supposed to go. (This feature turned out to be really helpful in yards.)

I also wanted the system to be portable and usable by anyone, so I elected to use Microsoft Word and Microsoft Excel as the computer applications on which to implement the system. You might consider that the input to this system is entirely manual. You are correct. If you automate too much, you have no idea of what is happening. I want to look at each car and make it go where I want it to go. After I make these decisions, that I find fun doing, I shall then, and only then, allow the automation to do the repetitive work of formatting and applying color codes, etc. for me.

After making some experimental paperwork for my own railroad, a few other folks saw it and heard about it by word of mouth and before I knew it, I wound up making near complete systems based on my schemes for 8 different people -- one in California and seven in Pennsylvania. And still others are currently in the works, to the detriment of work on my own layout. But I'm having so much fun that, who cares? In keeping with our always presumed agreement that when we do this model-railroading thing, when we are at someone's house, we do it his way, each of these railroads is implemented with slightly different tweaks and styles. That includes everything from printing on different colors of paper, to using waybills in ways that I never envisioned or intended. But we all do what the host wants and it usually works.

What are the essential parts of a complete "system"? The visible things, paperwork products, that you and your operators immediately see include:

Item of paperwork	Comments
Loco card	Identification of the DCC code and description of individual locos that will power your train. The card is folded to form a pocket that holds a Crew Brief card. You can print steam and diesel cards on different colored card stock. If a loco has sound or any constraint you can highlight that information in color.
Crew Brief	A crew instruction summary for your train showing the train direction, origin, destination, where the train is staged, where it will end, and any special work details you need to operate that train.
Car Card	One per car identifying the equipment by type, number, distinctive markings, constraints, if any, and a return location if no other routing instructions are present. The card is folded to form a pocket that holds a Waybill.
Waybill	A collection of instructions and details that show a car's load, where to route the car, and, sometimes, what to do with the car when it gets there.
Time Table schedule	If Time Table and Train Orders are used.
Schematic	At both overview and tedious levels of detail.
A summary master schedule	This summary displays data of interest to dispatchers, yard masters, crew callers and anyone else interested in the expected sequence of trains.
A yard specific schedule	This extract of the master schedule gives more details about each train that are of interest to yardmasters, but to avoid cluttering the yardmaster with unneeded entries, omits trains that do not reach or at least go past each specific yard.
Divider card	Cards that are labeled for easy identification of specific car card groups. They are used to distinctly separate groups of car cards during yard classification work, and also to identify packs of car cards for pre-staged trains.
Operator Guide	This is the counterpart to the prototype Employee Timetable. It contains the local "Rules" governing crews during operation on your railroad. Yes, they did it that way on the prototype, and yes, you considered that as an option, but no, we don't do that on your railroad, we do what it says in here.
Yardmaster Guide	This document is similar to the Operator's Guide but with instructions specific to yard operations.
Dispatcher Guide	This document is also similar to the Operator's Guide but with specific guidance for dispatchers.
Dispatcher's Train Program	A list of all trains showing their directions and special facts, such as work stops, turn points, etc., hints needed by the dispatcher to better control traffic flow.
Dispatcher's Train Sheet	The master two-dimensional chart that shows stations preprinted (vertically) with places to write in the names of trains (horizontally) for use by the dispatcher in following train clearance limits and progress. (Some systems are stable enough that we also preprint train names.) The chart shows traffic on one direction on the left side of center and traffic in the opposite direction on the right of center.
Yard Classification Guide	An extract of the Summary Routing Matrix specific to a particular location.

Behind the scenes, there are some additional components. A few of them are listed below.

File	Type	Description
The Routing Matrix	MS Word	This chart shows each significant location along the railroad, including staging areas, and shows how to route a car destined for any other location. This matrix is essential to whoever creates the waybill schemes used in this system because it provided a reference that helps avoid illogical routings. Yardmasters also find the Yard Classification Guide, a yard specific extract of the Routing Matrix, useful to help determine what trains to put cars on.
The industry list	MS Excel	This master file defines each industry on a track-by-track (and as detailed as spot-by-spot if so desired) basis showing the car capacity at each location. It is also used when creating waybill schemes to provide a balance of traffic to each industry and to identify logical loads in and out of each industry.
The loco list	MS Excel	This master file shows every locomotive on the railroad. It is broken into two parts -- steam and diesel. It also serves as a data source for generation of the loco cards.
The car lists	MS Excel	These master files show every car on the railroad. They also serve as a data source for generation of the car cards. Use two separate lists -- one for freight cars and the other for passenger cars. Include any un-powered rolling stock from freight cars, to Maintenance of Way equipment, to caboose or cabin cars on the freight file. Put all passenger cars and passenger-equipped cars, such as REX cars on the passenger file.
The train schedule	MS Excel	This master file shows every train that will run in the railroad. It also serves as a data source for the Crew Briefs, and is the basis for generating a dispatcher's train program (hint sheet).
The loco card templates	MS Word	These files format data from the loco list into an arrangement suitable for presenting essential steam or diesel loco info to operators.
The car card templates	MS Word	These files format data from the car lists into an arrangement suitable for presenting to operators.
AAR Code Conversion Table	MS Excel	List of the numerous AAR codes (such as FM) and the associated car Type (such as Flat).
The waybill templates	MS Word	These files format data from the waybill schemes files into standardized arrangements and apply appropriate color-coding to various parts of each waybill. One variation handles single car waybills and the other formats waybills for blocks of cars.
The waybill schemes	MS Excel	These master files contain details of every waybill scheme. I keep these data sources for single car waybills and block waybills on separate files.

I shall discuss each of these components in greater detail as I explain its importance, how it is used, who uses it, and how it fits into the overall system. But, before doing so, I need to digress to the waybills and offer a terse introduction to the routing hierarchy concepts associated with them.

------------ First Digression --------------

The unique feature of this system is that the waybills are color-coded and contain a sequence of four waybills arranged in a scheme that facilitates restaging and provides a natural logical flow when the four waybills in the scheme are used in order. Some layout owners use the VIA on waybills in other ways, such as to show the sequence of railroads over which a car must pass to reach its destination. In this system, the VIA is a geographical place. It may name a place such as a yard on the modeled portion of the railroad. Or, it could name an off model place such as a yard or city toward which the modeled railroad traffic flows. You can consider these named places as nodes on a graph. That is, on a network of interconnected lines (the graph) the nodes are the places where these lines intersect. View the lines of track along a railroad as if they are lines of a network or graph. And then, view the places that these lines intersect, such as at classification yards, as the nodes. By naming each node, then from any point on the network, you can determine a routing along the lines, possibly passing through other nodes enroute, to the node that is your destination.

If you now assign a color code to each node, you can visually convey information about the destination of a car and the necessary routing to get it there with just a glance at the color. When I mention color for these nodes, I am actually referring to a combination of different colors for the text and the background.

Let's take a specific example. You have an east/west railroad with off model staging in the west at a city called Sunset. In the middle of the railroad, you have a major classification yard at the modeled city of Center, from which several industrial local trains originate. In the east, you have more off model staging at the city of Ocean City. Finally, to the north of Center is another smaller yard near the city of High where other locals originate.

Routing Hierarchy level ONE

You can now select your VIA names as VIA OCEAN CITY, VIA CENTER, VIA HIGH and VIA SUNSET. Then, you can color code OCEAN CITY as Blue, CENTER as Yellow, HIGH as Green, and SUNSET as Red.

These color codes assist you in making decisions at the highest level of the hierarchy of routing that assists in guiding delivery of this car to its destination. The highest level? Yes. This color code is useful for getting this car to an appropriate yard. It is really helpful to the yard crews when classifying cars. If your car is in SUNSET and it is coded Blue to go to OCEAN CITY, that's all you need to know on this waybill. As OCEAN CITY is a staging area, once the car is there you are done. But, look at your next car with a Green color coded VIA HIGH waybill. You have no direct track or train from SUNSET to HIGH. So, you have to set out this car from the train when you reach CENTER. The CENTER yardmaster can then put in on another train to continue its journey to HIGH.

Routing Hierarchy level TWO

Now that the car has reached HIGH, you are ready for the second level of the routing hierarchy. The Yardmaster at High has to put this car on a local train for delivery to a specific city. To accomplish this, he would block it with other cars for the same city. If your local serves two or more cities, the yardmaster would block cars for each city.

To make it easier for your yardmaster to classify these local cars into blocks, you can color code each destination city name. Use Blue to code cars headed TO: **Newville, PA** and Red to code cars headed TO: **Carlisle, PA**.

Routing Hierarchy level THREE

Once the cars are on the local train, the road crew is ready to use the third level of the routing hierarchy. Here, you don't use any colors. The name of the industry is the place where you will deliver the car.

Routing Hierarchy level FOUR

This level of the routing hierarchy is optional. Because it is optional, you will normally not see it on a waybill. But, when you do need it, it is very important, because this information is the specific detail about special spotting for your car, such as at a particular dock door or on a team track. So, you will highlight this instruction boldly.

In summary, use the first routing hierarchy level the, color-coded VIA location, during staging and in yards to get the car on the right train to get it headed toward its destination. Use the second routing hierarchy level, the color-coded destination city name, in yards to classify the car on to the correct local train and as a local crew member to get it to the correct destination city. As a local crew member, use the third routing hierarchy level, the industry name, to get the car to the correct industry. And finally, as a local crew member, use the fourth routing hierarchy level, the spot information, to place the car at a specific spot.

--------------- End of First Digression --------------

Now let's get back to the individual units of this system starting with preparation, and also what files exist behind the scenes that allow us to work toward the final paperwork products that the crews use during an operating session.

<div align="center">A Schematic.</div>

Although listed in the above charts with the other final paperwork products, an overview terse schematic is an essential first step. Why essential? Because in order to identify the nodes that will become the VIA points, you need an accurate picture of the graph (rail network). You may think you know your own railroad, but many

owners are surprised when they actually draw the lines of the track in schematic form and realize that "you can't get there from here". But, with the schematic in hand (printed from an MS Word file made using the drawing features in MS Word), you can now confirm the places shown on the drawing in black and white as the nodes you need to use. What places will be nodes? First, your staging areas will be at least one node each. It is sometimes convenient to make one staging area serve as a representation of two or more distinct off model places. That situation is perfectly normal.

Next, your major yards should each be a node. Define a major yard as a classification area where any through freight stops to set out or pick up cars or from where at least one local train departs.

Occasionally, an interchange point can be a node.

If you miss any places, their need will soon become apparent and you can add them later. But, with your named list of nodes, you are now ready to get started. You have a picture in your mind, reinforced by a picture on paper, of how the places on your railroad interconnect with all the bridges and tunnels and curves and loops removed so that you see the true graphical representation of your network of tracks.

<u>The Routing Matrix.</u>

Formalize that picture. Make a list of the node names. And from this point on, let's start calling these the VIA names. You can put them in alphabetic order if that suits you. Or, you can start at one end of your railroad and list the names in sequence until you reach the other end. Sometimes using that order helps to further reinforce the visual picture you formed with the schematic. If you encounter a branch, take one leg to its end, then return and continue with the other.

The purpose of the Routing Matrix is to answer this QUESTION,
"If a car is <u>here</u> and it needs to go to <u>there</u>, where do I send it <u>NEXT</u>?"

If two places are next to each other and connected by track, the answer is simple. Just send it directly <u>there</u>.

But two places are not always so close. As your track network gets more complex, you may find more and more places where you can't get there from here (sometimes because the train the car is on is not authorized to go on the track to that place). As you create your Routing Matrix, you will answer the QUESTION from each place on your railroad to each other place. Using our example VIA names, here is what the initial work copy of our matrix would look like for that simple arrangement.

If a car is at	1st destination (put it on a train to)	2nd destination	3rd destination	Final Destination (and it needs to go to)
OCEAN CITY	CENTER	>>===----------->>>	>>===----------->>>	CENTER
OCEAN CITY	SUNSET	>>primary route-->	>>primary route-->	SUNSET
OCEAN CITY	CENTER	SUNSET	>>alternate route->	SUNSET
OCEAN CITY	CENTER	HIGH	>>===----------->>>	HIGH
CENTER	OCEAN CITY	>>===----------->>>	>>===----------->>>	OCEAN CITY
CENTER	SUNSET	>>===----------->>>	>>===----------->>>	SUNSET
CENTER	HIGH	>>===----------->>>	>>===----------->>>	HIGH
SUNSET	CENTER	>>===----------->>>	>>===----------->>>	CENTER
SUNSET	OCEAN CITY	>>primary route-->	>>primary route-->	OCEAN CITY
SUNSET	CENTER	OCEAN CITY	>>alternate route->	OCEAN CITY
SUNSET	CENTER	HIGH	>>===----------->>>	HIGH
HIGH	OCEAN CITY	>>===----------->>>	>>===----------->>>	OCEAN CITY
HIGH	CENTER	>>===----------->>>	>>===----------->>>	CENTER
HIGH	SUNSET	>>===----------->>>	>>===----------->>>	SUNSET

As your railroad becomes more complex, you may need a 4th or 5th destination, especially to show all of your alternate routings.

Why do we want to put in all these intermediate destinations and alternate routes? Also, to help us understand our railroad. But primarily to make sure that we didn't forget anything. However, we don't need these extra work version columns in the final version of the matrix. Why not? Look at the entry for a car at OCEAN CITY that

needs to go to HIGH. The matrix tells us to put it on a train to CENTER, its first destination from where it will then be sent to HIGH, its second destination. As HIGH is also its final destination, we need no entry in the third destination column.

But, now look at the entry for a car at CENTER that needs to go to HIGH. That entry shows us to put the car on a train to HIGH. Well, that is an identical "answer" to our routing question that we found by looking at the second destination column under the OCEAN CITY to HIGH entry. So, if we get the car to CENTER, we really no longer need to refer to the second destination on that row of the matrix, but instead, we can jump down to the CENTER entry and continue from there.

The same logic applies to alternate routings. Look at the entry for a car at OCEAN CITY that needs to go to SUNSET by its alternate routing. The matrix tells us to put it on a train it CENTER, its first destination from where it will then be sent to SUNSET, its second destination. But, now look at the entry for a car at CENTER that needs to go to SUNSET. That entry shows us to put the car on a train to SUNSET. Well, that is again an identical "answer" to our routing question that we found by looking at the second destination column under the OCEAN CITY to SUNSET entry. So, as before, if we get the car to CENTER, we really no longer need to refer to the second destination on that alternate routing row of the matrix, but instead, we can jump down to the CENTER entry and continue from there.

After making sure that you did not omit anything, you can now reformat your matrix and eliminate all but the first destination column. Let's also swap the order of the columns so that you can read the table as an English language sentence. Your matrix would then look like this.

If a car is at	and it needs to go to	put it on a train to
OCEAN CITY	CENTER	CENTER
OCEAN CITY	SUNSET	SUNSET
OCEAN CITY	HIGH	CENTER
CENTER	OCEAN CITY	OCEAN CITY
CENTER	SUNSET	SUNSET
CENTER	HIGH	HIGH
SUNSET	CENTER	CENTER
SUNSET	OCEAN CITY	OCEAN CITY
SUNSET	HIGH	CENTER
HIGH	OCEAN CITY	CENTER
HIGH	CENTER	CENTER
HIGH	SUNSET	CENTER

We can now further reformat this matrix into a summary form so that it looks like this.

If a car is at	and it needs to go to	put it on a train to
OCEAN CITY	CENTER HIGH	CENTER
	SUNSET	SUNSET
CENTER	OCEAN CITY	OCEAN CITY
	SUNSET	SUNSET
	HIGH	HIGH
SUNSET	CENTER HIGH	CENTER
	OCEAN CITY	OCEAN CITY
HIGH	OCEAN CITY CENTER SUNSET	CENTER

The same information is present, but it is consolidated. You can cut this matrix into four pieces, call each piece a Yard Classification Guide, and post one for reference at each VIA location. If you are staging at OCEAN CITY, then looking at the entries, you can build trains for CENTER using cars routed VIA either CENTER or HIGH (though, I would hope that you block the CENTER cars and the HIGH cars separately).

What happened to the alternate routings? Be aware that they exist in case you want to use them. I have omitted them here because most railroads won't need them, but if you want, you can make an additional summary matrix that includes alternate routings.

Aside from posting copies of the final summary version for easy reference by yardmasters, what other good does this matrix serve? It is a guide to you when making waybill schemes. If you refer to the matrix as you design

each waybill, it will help you avoid flipping a waybill and having it send the car to an illogical destination or back to where it already is.

This may be a good time to mention what happens when a car is sent to the wrong place by mistake. In this system, it really doesn't ever matter where a car came from or how it got there. What matters is where it is going. So, let's say that a car gets blocked in, and then forgotten about and it winds up in the wrong train. If the crew notices it enroute, they can set it out at a convenient next yard at which they are scheduled to work (please, no impromptu work stops just to set out a misrouted car). Or, if it gets set out with the other correctly blocked cars and the yardmaster finds it, he has to deal with it. As we noted, it doesn't matter how it got here. You need be concerned only with where it is supposed to go. So, the yardmaster who winds up with it has only to look at his routing matrix and place it on a train going in the right direction. The car will make its way back to where it is supposed to be. The system is self-correcting.

The industry list

This essential working master file helps you keep track of the number of cars you send to each industry. It is a repository of the details of each industry served by your railroad. Here are the basic data fields on it:

Location	Comments	Example
Location	In the form City, ST(ate)	Allentown, PA
Name	How will the crews know this place?	Neuweiler Brewing
Business	What does this industry do?	Brewery
Receives Products	Car loads expected here	Coal, Bottles, Grain, Hops
Ships Products	What are the products (and waste products)?	Beer
Served from Yard(s)	Where do the local(s) that service here come from?	East Penn
Servicing RR	When there is more than one RR on your layout	LVRR
Max Track Capacity	How many cars fit at one time	7

In addition, there is some manipulation of data that uses these additional fields.

Location	Comments	Example
Loading Factor	How many cars do you want going here per session (on average) as a percentage related to the track capacity?	80%
Max waybills to make	Based on loading factor	6
Waybills already made	A work field. If you are proficient with Excel, you can pick up the counts from your waybill file to automatically update this value as you add each new waybill. Otherwise, you can just over key the number yourself as you make additional waybills.	4
Waybills to go	Computed from above two values	2
Car types needed in	Info to help you when making waybills	Grain hoppers (LO)
Car types needed out	Info to help you when making waybills	Reefers (RS)

You can express the loading factor as a percentage, with 100 percent representing the number of cars needed to fill the track four times. Why four? Because with your waybill schemes, there are four waybills in each scheme. If your track capacity is 2, then if you make 8 waybills (2 times 4) you could expect (on average) that going through the waybill schemes for four sessions, that if you get each car delivered to its final destination during the same session so that it is ready to be used with the next waybill in the next session, you will get about 2 cars destined for this track per session, on average.

Now, that is an ideal situation. If your railroad gets all cars delivered each session, with every single track in every yard empty, then you probably need more cars. The real situation is that some (hopefully many) cars cannot reach their destinations and will still be in yards at the end of a session so that there are some cars to put on early trains during the next session. Thus, 8 waybills for a single place may take 10 to 12 sessions to completely cycle through all four of the their destinations. So coding 100% and expecting to get 2 cars per session would be a pipe dream. But, it provides a starting point for you to use and a base from which to make adjustments when tweaking your system.

You should make it a hard rule that you never touch cars left (on classification tracks) in yards at the end of a session. Do not flip their waybills. These cars are still enroute. They have not reached their final destinations yet. You flip a waybill only when its car has reached the destination specified on that waybill.

I find that starting within the 50% to 75% range gives a good first shot. I use 50% when an industry has space for only 1 car, and I increase the percentage as the car capacity gets larger. If the number of available cars (or the number of available cars of a specific type) is a consideration, the lighter loading allows me to get at least one or two cars to each industry before I run out of cars by using them up elsewhere.

There is another way that you can use to control traffic flow. If you want to make 8 waybills take cars to a specific industry, you have a choice of making one of the waybills on the schemes of 8 different cars, or you can send 4 cars to that industry twice each. That is, you can send a car with only one of the 4 waybills in its scheme, or you can send it with 2 of the 4 waybills. You can also decide to mix sending some cars once and some twice. What is the effect of that choice? If you send 8 different cars, then the maximum you could ever get would be, by some statistical oddity, to get a session when all 8 of them tried to go to the same place all at once. But, if you send each car twice out of the four waybills of its scheme, then even with the occurrence of a statistical oddity, the maximum number of cars you could get at once is 4. Only one or the other of the waybills on each scheme can be active at one time. Thus, in addition to using the loading factor to influence the traffic flow to an industry, you can also cause a significant effect on loading by the way you allocate the waybills among the cars you want to go there.

When listing industries, I always include team tracks. They can take any type car and any load. I also include staging areas showing the track capacity of each individual staging track. Staging areas, like industries have a specific maximum number of cars that they can hold. By including them here, you can keep track of how many cars are going to staging and balance your traffic flow. If you have 4 tracks of 20-car capacity each in staging at one end of your railroad and 6 tracks of 20-car capacity each at the other end, then you may not be able to send equal numbers of cars in both directions. Resolve these matters now, not during a session when the trains heading into staging won't fit.

The Loco List

The loco list is the master data source (file) that contains all the detailed descriptions of your powered units. If you have dummy units, even though they are not powered you should include them on this list. You need separate lists for diesel and steam, but you can keep them just as separate worksheets on the same MS Excel master file. The data elements you need are:

Data Element	Comments	Example
Road Name	Full spelled out name of the railroad (or other loco owner)	Pennsylvania
DCC Address	For the entire consist	6027
Class	For steam only	Hudson
Type		SD 35
RR	Alphabetic reporting marks for the RR	PRR
Number	Loco number -- repeat RR and number up to 4 times for diesel consists	6027
Max cars (units)	What can this unit (or consist) pull on the level (test it to find out)	24
Sound	Does this unit have DCC controlled sound?	Yes
Constraints	Are there any constraints on use of this unit?	Yes
Text	If any constraints, what are they?	Yard use only.
Return To	Where do you want this unit returned to when not in use?	Enola Engine House
Usage	Freight ONLY, Passenger ONLY, or both.	F

If you have road units that are semi-permanently consisted, you can list up to four different diesel locos on a single entry on this list (as well as also listing them separately if you want to). That way, when you generate your loco cards, all listed units will be shown, but the single DCC code will apply to the consist, not necessarily to any specific individual unit.

If you want to frequently de-consist units, as with a local train that can work easier by separating two units during some switching moves, then list each unit on this file separately, and you can make an additional "Consist Card" that shows all of the units involved and a common DCC code for them. Place an identical copy of this Consist Card into the loco card for each such loco in that consist.

In addition to the above listed data fields, you can always add more fields for user comments that you don't necessarily need to print on the cards. (If you add info columns showing cost, date purchased, etc., this file can double as your insurance inventory list.)

The way that this data is formatted into loco cards (car cards work the same way) is by use of the feature in Microsoft Word to do mail merges. The mail merge is designed to permit you to create a form letter, then merge an individual name and address, from a data source, into the form letter printing a separate sheet for each recipient. I use the same principle, but instead of using form letters, I use formatted tables that contain the data I want to print on the loco cards or car cards. I then merge the loco (or car) data from these master equipment lists into the formatted tables. Form letters generally use one address per page. That would waste a lot of paper if we printed only one loco card per page. So, I have the formatted template set up with four cards at a time. Now tables in Microsoft work best when they are processed a row at a time. But, if we line up four loco cards on a page, the first item in the first row (Road Name) is for the first locomotive. The second item on the first row is for the second locomotive. But in this data source file, the second item on the first row is for the next data element pertinent to the first locomotive (DCC Address) -- not something we want to put in as a Road Name.

So to get around this problem, internally, in the master data source files (for both locos and cars) I automatically repeat the data for the first four locos way to the right on the first row. I then repeat data for locos five through eight on the second row, etc. Then when I merge the data, I can get all of the info for the first four locos from the first row, all info for the second four from the second row, etc. and the mail merge blindly formats exactly want I want onto the loco or car cards, four to a page. (This is an example of how a bit of knuckle work here makes a finished product that is easier to use.)

The Car Lists

Car lists are very similar to loco lists in both the way that you create them and in the way that you use them. You will need at least one car list for your railroad. If you run passenger cars only, you need a passenger car list. If you run freight only, you need a freight car list. If you run both, you need two lists.

Some folks prefer to organize some of their cars into blocks instead of making a car card for each car, especially for through trains that just go from one staging area, across the railroad, and into another staging area. That is OK, but as a starting point, you should still initially put all of your cars on these master lists. (A side benefit is that they will give you those good, accurate and current insurance inventories.) Once you list all of your cars, then you can make car cards for the individual cars and transfer essential info for the first and last car only of blocks into a car block file.

I put both the AAR code and the car type in these files, but rather than key the car type each time, I automatically copy the master conversion list of AAR codes into these files so that the software can do a lookup. I then just enter the AAR code (GB - PS - etc.), and the software plugs the correct car type (Gondola - Sleeper - etc.) for me.

The data fields needed for cars are:

Data Element	Comments	Examples
TYPE	Automatically looked up based on AAR code	BOX
AAR Code		XM
Road Name	Full spelled out name of the railroad (or other car owner)	New York Central
RR	Alphabetic portion of the reporting mark for this car	NYC
Number	Numeric portion of the reporting mark for this car	80775
Capacity	For passenger cars only -- number of passengers (or linear feet of cargo)	62
Load (or constraint)	For freight cars only -- visible loads for open cars such as gondolas, hoppers and flats. NOT for closed cars like boxcars or covered hoppers. Constraints can be for any car.	Coal Flour loading only
Markings	Any marking or identity aid	Premium Ham Black Door 3 domes
Return To	Where to route this car if the waybill is missing	El Paso, TX

Use this list as the data source for generating your car cars.

(I have considered adding a VIA to use in conjunction with the Return To field and printing these cards with the same color-coding as the waybills. This option may be of value if you want to use a different waybill strategy and remove waybills from cars when they are MTY. But, with the design of MTY waybills to handle MTY cars, the extra effort to print in color does not seem worthwhile for what would essentially be an emergency situation where the waybill becomes separated from its car.)

NOTE: In any merge from MS Excel into MS Word, you can designate that the top row of the source file is a title row, not merge data. You should also be aware that the "format" of the cells in subsequent rows of your MS Excel file is determined by the value in the first data row (not counting the title row). If you have fields that can be sometimes left blank, then when you do your merge, you want the merged fields to be blank as well (like the city the car came FROM and the SHIPPER on MTY cars.) If the field is defined as alphabetic, you will get blank or null fields merged as blanks. But, if the field is defined as numeric, you can get a zero in the merged results. You don't want a lot of zeros floating around on your paperwork where you expect blanks. To avoid this situation, you can put a "dummy data" row at the top of your MS Excel file (if you used a title row, put the dummy data row on the second row, immediately following the title row). If you want to define the field as numeric, just key "0" or "1" in that field. If you want to define it as alphabetic, just key "AA" instead. On something like a loco number or a car number, even though these fields are thought of as numeric, I use the "AA" to force these fields to be treated as alphabetic, thus merging blanks instead of zeros in places like the unused 2nd, 3rd, or 4th loco number when these additional locos are not present.

<u>The Train Schedule</u>

This is an important file. It won't be that long -- if you run 40 trains during a session, you need only 40 entries. But the info about each train has to be complete, so the list of elements for each train is big. You can also add a lot of extra data elements into this file to use for making extra goodies such as wall charts for arrivals at specific staging area tracks, etc. But let's limit our discussion here to the really critical stuff -- things that the dispatchers and yardmasters and crews need to know to move the people and the freight.

This file identifies each train showing where it came from, where it is, where you need to take it, and where it is eventually going. But before going into those matters, let's mention some administrative items. In the prior lists, I omitted reference to such things as sequence numbers, because on something like a list of cars, you can sort them any way you want and still print them in that order. As long as you print one card for each car, order doesn't matter. But now, we are talking schedule, so sequence becomes a lot more important. So, on this file, I start with a "listed" sequence number, followed by a couple of alternate run sequence numbers that you can manipulate to suit your needs. Some folks call these odd and even runs. Some call them First Half Sessions and Last Half Sessions. If you use Time Table and Train Order, you can call them Daily and Weekend sessions. You can make some dynamic session sequences with 6 to 8 variations and float in the one you want to use today. I also leave a couple of blank columns with such titles as Run Notes, or Print, etc. so that I can allow a place for the crew members to mark off trains during a session, or that I can use to select items I want to change or tweak.

Here is an almost minimal data element list for the train schedule file:

Data Element	Comments	Examples
Crew Call time	If using Time Table / Train Order (TT/TO) -- (fast clock time)	1535 (hours)
Departure time	If using TT/TO -- (fast clock time)	1735 (hours)
Authority	If using TT/TO	TT or TO (or sometimes both)
Railroad	Abbreviation letters for the Railroad	L&N
Train ID	What the dispatcher calls this train. Show both IDs if the train is a "Turn"	P-83 HY-3/YH-4
Train Name	Word name -- usually for passenger trains, but also for some freights	Broadway Limited Jeddo Turn
Status	Indication of whether this train is available for the current roster	Active
Change After	For turns, the place from which, when departing, you start using the new Train ID	Jeddo
Train Type	Freight or passenger, local or through	Local freight Express Passenger
Class	Essential if using TT/TO, otherwise, optional	2
Direction	If a turn, show both directions.	Northward Eastward/Westward
Origin	Where this train started (could be hundreds of miles away)	Baltimore, MD
Staged At	A facility ON YOUR LAYOUT where the Crew finds this train -- usually a yard or a staging area. Can sometimes even be somewhere on the mainline at the start of a session.	Enola, PA
Ends At	A facility ON YOUR LAYOUT where the Crew leaves this train -- usually a yard or a staging area.	Wilkes-Barre, PA
Destination	The final destination of this train (could be hundreds of miles away)	Buffalo, NY
Work at Yard A	Yard specific Yardmaster instructions for this train at this yard	Originates, takes Enola
Work at Yard B, etc.	Yard specific Yardmaster instructions for this train at this yard	Sets out; takes Gary and Parma
Max cars (units)	This number limit applies when this train leaves your modeled area and enters staging (based on capacity of staging tracks). At your option, you can make it a permanent limit.	28
Helper needed	If (and sometimes where) you want to force use of a helper	Yes
Power change (at)	For modeling interest, some trains can change power	Altoona
Yard A work notes	Supplemental train directing comments for the yardmaster specific to this yard such as guaranteed connection info, etc.	Do not allow to depart without milk cars from train RZ2
Yard B work notes, etc.	Supplemental train directing comments for the yardmaster specific to this different yard.	
Dispatcher hints	Administrative info about this train	Turns at Gordon
Dispatcher work summary	Work specific details such as location of work stops for locals	Work CV, MH, WX
Special Instructions	Detailed guidance to train crews providing essential info needed to successfully operate this train.	Use CP Timetable. In addition to passenger stops, pick up milk cars at Newport, Lyndonville, and Wells River. ----------------------- Work at Altoona. Set out all but Enola cars, pick up Enola cars

The data in the file is used to generate the Crew Brief card for each train. The Crew Brief is a two-page insert that is the same size as a waybill and fits into the pocket of a loco card. The same data is also the basis of a master schedule and yard specific schedules as well as the Dispatcher's Train Program (hints).

The loco card templates

These templates are MS Word mail merge documents. I use separate slightly different templates for diesel and steam, and I print the resulting loco cards on different colored card stock. These templates contain the tables of data formatted with gridlines and triggers that print a few words with different colors and styles. Their function is to organize the loco data plucked from the data source, the loco master file, into a presentable form that is easily understood and useful to crewmembers. The most important elements are closer to the top. The end result of the merge into this template is printable pages of four loco cards per page that you can cut out and fold into individual loco cards with a pocket at the bottom into which your crews can insert their Crew Briefs. The resulting loco cards are identical in size to car cards, so the loco card(s) with the inserted crew brief becomes a sort of cover sheet for the train's stack of car cards with their inserted waybills.

The car card templates

These templates are also MS Word mail merge documents. I use separate templates for passenger cars and freight cars, and I print the resulting car cards on different colored card stock (usually manila/ivory for freight cars and white for passenger cars). These templates contain the tables of data formatted with gridlines. As with the loco card templates, their function is to organize the car data contained in the data sources, the passenger and freight car master files, into a form presentable to and easily useful to a crewmember. The end result of the merge into this template is pages of four car cards each that you can cut out and fold into car cards with a pocket at the bottom into which you can insert waybills and other miscellaneous alert cards.

AAR Code Conversion Table

This table contains three columns listing the generic car type, such as FLAT, the AAR Code, such as FM, and a descriptive comment. As many AAR codes convert into the same type (both FM and FD convert to FLAT), the description provides a reminder of the distinctions. I copy the current version of this table into the master car list files, and then I use it to look up the car types. That saves a lot of keying when creating the master lists and saves making spelling errors. It also provides a consistent conversion rather that one done from memory. Some folks like to be tedious in their use of codes and research the values they want for each car, taking great pains to make the distinction between XP, Boxcar for Paper or other specific commodity, and XL, Boxcar equipped with load restraints. Others are satisfied to just use XM, the generic boxcar code for all of their boxcars.

Because AAR codes don't change a lot, this is a very stable file, and is one of the files that can be shared across different model railroad systems.

--------------- Second Digression ------------------

Before discussing the last two files on the behind the scenes list, let's think a bit about waybill concepts.

In this system, I group waybills into schemes that each provide a sequence of four waybills designed for use with a specific car. Why a specific car? Many railroads are staged by removing waybills from the last session, finding a new one that seems appropriate, and replacing that new waybill into the car card. Now, do that for 500 cars. One of the railroads where I set up this system has over 700 freight cars. Even with some blocks of cars, making individual waybill decisions can get really tedious. (Do you want to have an ops session each month, or only once a year?)

By designing a waybill scheme for a specific car, you can accomplish several things. First, you avoid the obvious miss load. You will get no accidental load of lumber on a tank car. Second, you can always return empty (MTY) cars where you want them to go with the routing you want. I never intentionally remove a waybill from its car card. Rather, I include MTY as the "load" for some of the waybills and I route the car where I want that MTY to go. You will not get a Union Pacific car being returned MTY to Portland, ME. when using this system, unless that is where you specifically want it to go. If you have the staging capacity to handle it, your MTY cars get routed back to their owning railroad.

Also, you will get a consistent traffic flow. Look at a specific industry. If you design your system to send 8 cars to that industry, then over a series of sessions, all 8 will eventually get there. Some of the railroads that use this system have a 300-car capacity at their combined industries. If you leave it to chance to remember to find a waybill for each industry each time you stage, you will need a master schedule just to manually keep track of them, what type of loads they get, what type of cars they get, etc. By designing the waybills for specific cars, you will always get the right types of cars to the right industries with the right, logical types of loads. They may not always get there each session. You will get a statistically varying distribution of traffic flow. Sometimes nothing, sometimes a lot more cars than the railroad can handle. No repetitive boredom here. On the other hand, once there is at least one waybill scheme for each car, you can always -- if you want to -- swap them among different similar cars. That is your call.

Another minor reason for designing a waybill scheme for each specific car is that you are then sure that you have enough waybills. And, by designing the flow of traffic by the sequence of the waybills in each scheme, you will avoid having the same cars always appearing in the same train to the point that it starts to bother operators because they recognize them. Yes, each car will eventually repeat its cycle, but it will probably be well out of sync with other similar cars, especially if you send them in different directions on other waybills in their schemes. A car that reaches an industry during your April session may not see that industry again until August at the earliest. Most of your operators will have forgotten that car by then.

With four waybills in a scheme, some other systems that I have seen use a pre-printed card that has its four waybills printed with 2 on each side, and the ones on the same side are upside down from each other. These cards have to be filled in manually. I do not have the equipment to correctly register the printing on both sides of a page so that everything lines up perfectly. Nor do I have the skills to print upside down on half of each card. So to accommodate my deficiencies, I decided to print everything right side up and all on one side of each page. I tried printing a scheme of four waybills in a strip. Then, instead of cutting our each waybill individually, I cut out the strip of 4 and folded them with an accordion type fold. This arrangement worked very well, so I settled in on it.

Flipping waybills at the end of a session consists of looking at the waybill number (1 through 4), refolding it if necessary (sometimes the way the fold goes, you can just turn the paper over) to show the next waybill in the sequence, and replacing it in the car card. No thought required. No mistakes to be made. No running out of waybills for the place you want to send another car. No illogical routing. No illogical loads.

By printing the waybills in strips, I can fit four strips on a page. They are tedious to cut out when doing one massive print for a 500-car railroad. But after that initial effort, you can easily tolerate reprinting and cutting half a dozen at a time. In any event, it sure beats writing them all in by hand.

--------------- End of Second Digression -------------------

The waybill templates

These templates, one for single cars and one for blocks of cars, also MS Word mail merge documents, are close to the heart of this system. I make unique template files specific to each different model railroad layout. Like loco and car card templates, these templates format data into an arrangement presentable to your crewmembers. But, unlike the other templates, these require a lot of behind the scenes effort. Instead of just pulling the raw data from the data source files as with the other templates, on these files, I use conditional statements to specify the color codes selected for use in highlighting VIA locations and to color the different city names on the TO line of the waybill. These conditional statements are not really macros to me, so I call them mini-macros. Using them, I can look for specific text values, which, when found, trigger the use of specific color combinations for the text and the background highlighting of that text.

And what is that text? It is the name of the VIA location. Or, it is the name of the city to which the car is to be delivered.

Now is a good time to mention accuracy. If the mini-macro is coded to look for a very specific character string, it must find exactly that character string or it will get a miss. If you want to print VIA Cresson with white text on a blue highlight, then you better have the exact word "Cresson" keyed into your data source file. If you key "Creson" or Cresso n", you won't get your color, but an error mark instead. The same goes for destinations. If you want to print TO: **Tamaqua, PA** as your destination in red, then you better have the exact character string "Tamaqua, PA" keyed in your data source. If you key "Tamaqua PA" or "Tamaqua, PA", you won't get color. In these cases, you won't get an error, but the text will print in black instead of red. What is wrong with these two

bad Tamaqua examples? The first is easy to spot. The comma is missing. The second can be a little more difficult to see. In that example, the comma is present but it is followed by two spaces instead of just one.

<u>The waybill schemes</u>

These data sources are what make your railroad come to life. You need two separate files, one for single car waybills and one for blocks of cars. These two files form the master collection of all instructions that direct where to move your cars. Your train instructions tell you how to move the cars you have decided need to be on that train, but these files tell you how to determine which of your cars need to be put on that train to start with.

The data elements you need can be broken into a couple of subordinate classifications that I call levels of <u>Need</u>. Let's call them Administrative (A), Boilerplate (B). Essential (E), and Nice-to-have (N).

Administrative items assist you. You need a way to identify each waybill so that you can find it in case you need to change it. You need a way to confirm that you have the correct version of a reprinted waybill.

Boilerplate items are "scenery". They are optional "filler" details that you don't really need to know to successfully operate, but that are nice to have, and when present, provide completeness to the illusion that you are operating a real railroad. (The word "illusion" here is not something bad. It is an appropriate term to describe something that you are trying to achieve -- operating your model in as realistic a manner as possible. The better you are at creating illusions, the better your sessions will be. If you have distractions that disrupt your illusions, such as malfunctioning locomotives, incorrectly positioned equipment, missing loco cards, wrong DCC codes, un-flipped waybills, miss staged trains, bad track, etc., you will have a poor session.)

Essential items are things that you cannot operate without. If one is missing or wrong, something will not work right. Either you will not be able to generate a waybill at all, or you will have inconsistent or conflicting results if you do get a waybill.

There can sometimes be a shading of opinion between whether something is essential or boilerplate. If you say that this car has a load of sugar, that reinforces your illusion of realism. If you say that this car has a load, you can still operate. If you don't even state whether the car is loaded, you can still operate and deliver the car to the bakery. Who cares what is in it? Do you? Do your operators? So is the load Essential or Boilerplate? You have to decide yourself. In the following list of data items, I'll let you know my opinion by calling these items Nice-to-have. I consider them essential, if for no other reason than their contribution to your illusion of realism. But, the final decision is yours. (It also gives some operators something to read and find mistakes with while they are bored waiting for a clearance.)

In addition to the data elements shown in the following list, I also add a few blank columns so that I can mark selected individual items for print. In all cases, each master file contains at least these fields:

Data Element	Need	Comments	Examples
Scheme ID	A	A name for a scheme of four waybills	S-147
Waybill Number	A	1, 2, 3, or 4	3
Car Type	E	Automatically looked up based on AAR code	Gondola
AAR	E	To correctly design this waybill, you need to know what kind of car you are dealing with.	GB
Routing	N	Name of a train. Aid to yardmaster to correctly get a car on a specific train -- especially useful for locals. (Do NOT use when this car can go on any train.)	CO-NO
VIA	E	First level of routing hierarchy. (also used to specify RESTAGE for some unique cars like loaded or MTY coal hoppers)	Norton
TO	E	Second level of the routing hierarchy. Format is City, ST(ate)	Chicago, IL
Receiver	E	Third level of the routing hierarchy. Name of the industry. If the car is MTY, this name can sometimes just be the owning railroad.	Trumbull Mfg. WM
From	N *	Format is City, ST(ate)	Winchester, VA
Shipper	N *	Name of the industry	Opequon Orchards
Contents	N *	What is in this car?	Apples MTY
Spot	E	Fourth level of the routing hierarchy Specific place to spot a delivered car	Spot at Starch Silo
Constraints	N	Anything unusual. If a car has a permanent visible load, list it here so that if the waybill says MTY, the crew will know it is an intentional conflict.	Has lumber load
Designed for Car	E	Reporting marks of the car you are making this waybill for	NW 41939
Open load Code	A	If you swap out open loads, you can specify here which load goes back on this car when you flip to this waybill again.	L-014
Version	A	Number of days since 31 December 1899. Shows when this waybill scheme was last generated. If you find two waybills for the same scheme, the one with the higher number is the more current version.	38951
Block ID	E	For blocks of cars only	B-07
Car count	E	For blocks of cars only	12

* When a car is MTY, do not specify From or Shipper. Industries don't generally ship MTY cars. They come from the railroads.

As mentioned previously, spelling and punctuation in these files is critical. As they form master repositories of all the traffic movements and flow details for your railroad, you can also use them to provide all sorts of good analysis tricks to find out what is happening. If you spell "Pittsburgh, PA" the same on every entry, then you can scan this file and find out how many cars you have going to Pittsburgh. If you spell "Winston Mfg." (including the period) the same way on all entries, then you can scan and find out how many cars go there. But not if you spell it Winston Mfg in some places and Winston Manf in others. Decide on the correct invariant way that you will spell each location and each industry and use that exact same character string forever.

Enter the individual waybills into the Excel file one per row. As there are four waybills in each scheme, you have to treat each group of four consecutive rows as a package. Yes, you can resort them to work on like data elements in a convenient way, but before a preprint merge, the packages have to all be placed back in order. Accordingly, the "normal" sort for these files is by Scheme ID ascending, then Waybill Number ascending.

The size of this file if you put 700 cars in it could be overwhelming to your PC. With about 15 fields to merge on each waybill, times 4 waybills per scheme (that's 60 fields per scheme to merge already) times 100 schemes (that's now 6000 fields to merge), even a fast PC takes a while to do all that merge work, and needs a lot of dynamic storage space to organize it in. So, I break the schemes into groups of 100 each. That gives 400 individual waybills in each group. I put each group of 100 schemes on a separate worksheet in the Excel master data source file. When I merge them, I limit the merge to 100 schemes at a time, and that's still a stack of 25 pages when I print them on my color laser printer. But that makes working with the large number of schemes much more manageable and quicker.

How do you create a waybill scheme?

If you are lucky, you have lists of real industries that existed during your modeled era. A few of the folks I have created systems for have provided me with such lists. They proved really helpful, especially for identifying off model industries, the places where loaded cars come from and places for your modeled industries to ship cars to. You can always use the previously published industry lists available on the internet. On your model, use the industries you have placed in your track network and use the names you assigned to them. Do you have a couple of odd cars that won't fit anywhere else? Send them to a team track.

Let's step through creation of a scheme to see how to do it.

The first concern I usually hear is that someone will run out imagination and names. I have never had that problem, even when I did the model with over 700 cars. I just get out a handy dandy AAA individual state road map for several states and I'm in business.

Let's presume that you have already identified the nodes on your railroad by making a schematic drawing of your track network and a routing matrix. You have also listed all of your industries with their track capacities on your industry list. Select a car. You just bought some new cars including Covered Hopper AGP 95427, entered them into your master car list and printed new car cards. So let's use that Covered Hopper. You will need some cars to just stay on trains and go back and forth between staging areas. But for this exercise, let's look at your industry list to see if you have any industry that needs another car. You note that you have a factitious flourmill, served by a local train out of HIGH, that needs to receive grain and could use another car. You decide to send this car to that mill on one of its waybills. But, you also note that you would like to have some more cars that just fill trains running across your railroad. You can satisfy both needs with this car.

OK, you are ready to create waybill scheme S-137 specifically for car AGP 95427. So you start the car as if it has arrived at that mill (VIA HIGH) on (let's arbitrarily pick) waybill 2 of Scheme S-137. You can worry about the details of waybill 2 later. Moving on to waybill 3, which is the waybill of your scheme that will show when you flip it after the session during which it arrives at your flourmill, you now have to get this MTY car back to grain country for its next load. So let's make waybill 3 send it west (VIA SUNSET) to grain country. Where is "grain country". Well, Kansas sounds good to me. But, I don't know the names of any specific grain companies in Kansas, and I don't care to take the research time right now to find one. Here comes that handy dandy AAA map of Kansas. I once flew into Wichita, and I remember that it was pretty flat with lots of grain fields round about. That looks like a good starting point.

Just east of Wichita is a small town called Augusta. That's an interesting name, so let's send our car TO: Augusta, KS. Would that place be on a railroad? I don't really know, but when you look at the present day maps, it is not a coincidence that the main roads are where they are. These are the paths of commerce. The railroads tended to run along a lot of these same paths, so as Augusta is not more that a few miles from the main highways, it is reasonable to assume that there must have been rail service near it.

How about the RECEIVER? If this car was owned by a railroad, we could just say that the receiver was that railroad. But this is a grain hopper. Maybe we can be more imaginative. Grain shipments come from elevators where the grain is stored. It seems reasonable to me that this car may already be designated to go to a specific elevator for its next load, so let's send it directly to "that place". But, what is the name of "that place"? Well, looking at the map again, I note that Augusta is on the Walnut River. It is also near an Augusta Lake and just south of a much larger body of water called Dorado Lake. It is also just northwest of a place called Butler State Lake & Park. It is just west of a small town called Leon, and finally, it is in Butler County. Well, now we have lots of choices. We could call our receiving grain elevator industry:

the Walnut COOP
the Augusta COOP
the Dorado COOP
the Butler COOP
or the Leon COOP

I like Butler. Let's go with that. So our receiving industry will be the Butler COOP.

Now the beauty of the industry naming selection technique is that it contributes to your illusion of realism. To someone who has never been to Kansas, he won't know from Adam whether these names are real or factitious. But if someone who has lived in Wichita all his life sees your railroad and notices this waybill, because he knows that Augusta is in Butler County, he may actually convince himself that somewhere in the past, he has actually seen the Butler COOP grain elevator or that if he hasn't seen it, he has heard of it. Who knows? Maybe he really did. Maybe there really is such a place. But, even if there isn't, you have achieved your purpose. You have fooled him -- in a good way. You have successfully created the illusion of realism on your railroad.

Because this car is an MTY, you don't need a FROM and SHIPPER, so you are essentially done with waybill 3 of this scheme. So where does this car go next when you flip to waybill 4? Let's send it to an unmodeled flourmill. How about one near the coastal city of Ocean City on your railroad. You can pick any name you want here, because Ocean City on this railroad is in a staging area. So, this car will never actually get to an industry. Once it reaches the staging area, it is done. (Any name you want? Yes, but -- remember that illusion stuff? If you call it Horrible Hank's Gristmill in honor of your brother-in-law, you may get some mileage out of a family joke, but does that name support your illusion of reality? Also, keep in mind that there is a limit to the number of text characters that will fit across one line of a 2 1/8 inch card. There is virtue in picking short names.)

Let's route it VIA OCEAN CITY, TO OCEAN CITY, NC (or whatever state is appropriate to your model) with the RECEIVER being Hawk Flour Mills, and loaded with Wheat. As we have a load, now it's nice to show where that load came from. If you are short on imagination or time, you can use the name you already developed for this or another waybill scheme. Let's take that cop-out here and say that the car is coming FROM August, KS and that the SHIPPER is Butler COOP.

When you flip waybills in your OCEAN CITY staging area, this scheme gets flipped back to waybill 1, and you now have an MTY to go back to grain country again. You don't want to keep seeing the Butler COOP over and over again, so let's find a new one. Kansas is not the only state that grows grain. You can send this car back to the Rock Port COOP in the town of Fairfax, MO. How do we get it heading west? Send it VIA SUNSET. And when it arrives in Sunset, your west end staging area, it is done. At the end of the session, you flip the waybill and it shows waybill 2, the one you want to use to get it to your modeled flourmill.

So what values do you use for waybill 2? You already know that the car goes VIA HIGH, because HIGH is where you will put it on its local train for final delivery. So, your first few items are dictated. You must send the car VIA HIGH, TO Archdale, NC for delivery to RECEIVER Blue Rock Flour Mill. You might want to have the name Archdale, NC print in Blue color so that the yardmaster can easily sort it for the correct train. You may even want to specify a Routing on a specific train to further assist the yardmaster, let's say train L6. You want the car to contain plastic pellets. WHAT? PLASTIC PELLETS? In a covered hopper that carries food? No way! This is a grain hopper. Be careful that you don't mix incorrect products into the wrong cars. It is just as improper to put plastic pellets in a cement or a grain car as it is to put bricks in a tank car. No, you don't want to send plastic in this car to your flourmill. You want grain, so specify "Wheat" as the load. Now the only missing info is who shipped this Wheat. Remember waybill 1? On that waybill, you sent this car to Rock Port COOP in the town of Fairfax, MO. So, Rock Port COOP is a logical industry to use as the source of this shipment. BUT, IT DOESN'T HAVE TO BE. In fact, a lot of model railroaders have this hang up that they have to send each car to its next destination. NO, break that chain. This car goes off your model to dozens of other places before it may come back your way. So use this variation to enhance your illusion of reality. Send the car off layout to Chicago and bring it back with a load from St. Paul. Send it to Bangor, ME and bring it back with a load of imports from Boston, MA.

Let's pick a completely different source for your wheat on this waybill. How about FROM: Granada, CO with the SHIPPER: Bristol COOP? Sounds good to me!

Let's summarize some of the points you noted or subconsciously observed in creating this scheme.

The VIA names you use are a specific set of predetermined names. The sequence of VIA names moves the car back and forth across the railroad. You did not use the same VIA names on two consecutive waybills. Sometimes it is logical to do so. You could have wanted to move an unloaded boxcar to another track at the same or a nearby industry. In such a case, the VIA names on two consecutive waybills would have to be the same. But that would not apply in a staging area. Your intent is to provide for a logical next destination whenever a waybill is flipped, not to introduce a gridlock or a puzzle.

The city names that you use to show both the destination (TO:) and source (FROM:) are real cities, and you specify them in a specific style, that is City, ST(ate). (If using provinces in Canada, you can generally use three letter abbreviations where logical, such as ONT.) The names of some cities where your local industries are located can be color-coded.

You use the RECEIVER: and SHIPPER: names to identify either the industries on your layout or the load source and destination industries that you refer to, but that are off of your model. These off-model industries may be factitious or real, or a mix of both, at your option.

You specify loads that are logical as loads that the specific industries named on each waybill receive or ship, and that are appropriate for the cars that carry them.

You return MTY cars to the owning railroad. If you want to be tedious, you can route them specifically back by the same routes by which they arrived (if you know or can deduce such information). Short of that tight control on your MTY cars, you route them back by logical routes that will get them moving in an appropriate direction to get them back to their owning railroads. You do not generally send MTY Canadian Pacific cars south to Miami, and you do not generally send MTY Maine Central cars west to El Paso, TX.

You balance your total waybill counts for each termination point (staging area or modeled industry) in proportion to the available track capacities at those points.

When you operate, do you want all the waybill schemes to be on waybill 1 for the first session, then waybill 2 for the second session, etc.? NO. The waybills will get all mixed up. The sequence of waybills is relevant only with reference to their own scheme. One waybill number has no connection to the number of any other waybill. Some schemes might move their cars through all four waybills in four sessions. Others might take six or eight sessions, depending on how many connections you need to get it to each destination. So, don't worry about what waybill number you start with. Pick one that takes the car somewhere else from the place you start it, and it will merge itself into the traffic flow and do its thing. The first session, when all cars are starting with quasi-random placement may seem chaotic, but the flow will soon stabilize.

What about placing new cars on an already established railroad? You might find a convenient place to introduce new cars on to your railroad is a large industrial area. Even if a car will never see that industry again, it can easily get lost among the other cars in that area and it will work its way back to the main yards. If you start several cars in such a way, either all in one place, or scattered about at different industries, they will make their way back to the yards on expected trains. But, if you start a large group of cars in a main yard, you may give the gift of gridlock to that yardmaster as you tie up a whole track with cars he is not expecting to be there. So be careful about where you introduce new cars and try to meter their release slowly into your traffic flows. If you have more than a few cars at a time, place a few where they will be picked up and brought back to a yard on an early local train, and others where they will picked up later in the session.

That about wraps it for the principal files you need behind the scenes to support your paperwork. I now want to address the more visible items. Beside the items listed as the start of this article, there are numerous other pieces of paperwork that you can use to round out your system. Bad Order cards, Expedite Order cards, Overdue Shipment cards, Dirty Car cards and Empty Car Requests are all cards that you can insert in front of or behind a waybill to defer it from the normal route its waybill is trying to send in on, or to hurry that car along that route. You can print pockets to hold the Crew Brief cards for dispensing at a crew callboard. You also may need Train Order Forms, Clearance Forms, Train Register forms for use at stations where timetable meets might occur, Equipment Check forms for use when modeling such activities as setting retainers on freights at the top of hills. I'm sure that you can think of a few more that I haven't mentioned.

Accompanying this article, you can see the pictures of each of the major items. Most are self-explanatory, and most are all very familiar to us from prior editions of this journal. However, I want to provide some very specific comments on one more item, the Time Table Schedules that you will need to make if you operate using Time Tables and Train Orders.

I make the Time Tables using tables in MS Word. The ability to combine or "merge" of cells in Word tables allows for very flexible manipulation and formatting of the table to emphasize important text in larger cells. Because of my military background, I think in 24-hour clock time. When I look at a 12-hour clock in the afternoon or evening, I mentally convert the time to 24-hour notation. So, I make my own timetables using 24-hour times. No AM or PM. No colons. No confusion as to whether a time is in the morning or evening. Just four numbers: 1855 hours. No confusion I don't know whether any prototype railroad ever did it that way. I don't care. Remember that it's my railroad, so when we're at my house, we do it my way.

Regardless, however, of what time notation you use, there are some things you can do to make your timetables easier to read. First, the sequence of trains listed on your timetable can be by class, by type or other organizations. Based on the recommendation of a friend who is currently a dispatcher on a prototype railroad, who told me that after lots of trial and error, the real railroads found this to be the best way -- easiest for crews to read and understand, I have found, that if you list your trains in a sequence the same as the order that they reach a common station, you can more easily follow across the page and find the next train you have to worry about. So, I recommend that method. Now, not all trains reach every station on the timetable schedule, and some trains may run faster than others. But if you pick a major station near the middle of the schedule and arrange the train sequences at that point, then even though they may not all be in the exact order at distant stations, they will be close enough to accomplish your purpose of easy reading. If some trains don't reach the station you base your sequence on, merge them in based on their times at a significant other station that they do reach.

You should put your trains running in the superior direction on the left side of the page, and also state what that superior direction is in a prominent note at the bottom of the timetable page. At the top of each side of the page, along with an arrow, state what direction that side is and in what direction you read that side of the timetable, for example:

Read DOWN ↓ Southward		Read UP ↑ Northward
	or	
Read DOWN ↓ Westward		Read UP ↑ Eastward

In your timetable header, obviously, you need your railroad name. You can also put a couple of lines that identify this timetable number and specify its effective date:

Pennsylvania Railroad
Timetable Number 3
Effective 0201 hours EDT Saturday 1 June 1963
------------------ or ----------------
The Mechanicsburg and York Railroad
Mand**Y**
Timetable No. 1
In Effect At 12:01 AM Thursday, 28 September 2006 Eastern Standard Time

Stating the effective date is a good way to let everyone know the era you model. And in the interest of domestic tranquility, you can even incorporate your anniversary date or your wife's birthday (day and month, not the year), so that she knows you are still thinking of her even when you're deep in railroad land. (My freelance railroad name even enabled me to incorporate her name.)

You want to list your stations in sequence. But, what if you have a branch? How do you "list" something in sequence if is shaped like a wye? When you come to the fork in the track, take one branch and continue in sequence along that branch. Then return to the station that was at the fork and start in the next available space after the last station of the branch you already completed with the first unique station of the other branch. When the one leg of the fork is the main line and the other is a branch line, I prefer to continue on the branch first, then jump back and continue the mainline. You can then shade the branch line stations to highlight them. The shading helps anyone using the timetable instantly recognize that the branch exists. If you want to see a

prototype example, go to any AMTRAK station and pick up a current train schedule. You will see dozens of examples.

Put your times before noon in normal font and put your times after noon in **bold font**. I do this even with my 24-hour notation. If you use 12-hour notation, also put AM or PM after each time. If you have a meet or pass for two timetable trains, underline the times, and above the meet times in each trains column, list the identity of the other timetable train(s) participating in that meet or pass. For passenger trains, put the letter "S" to the left of all other characters on the first time shown at each place where that train is to make a passenger stop. Your crews will love you if you do this, because it immediately resolves the question for them as to whether a time listed at a station is supposed to represent a passenger stop or if it is just a schedule time.

All times on a timetable are departure times unless otherwise stated. You may arrive early, but you may never depart early (unless so authorized by the dispatcher). If you have both an arrival and a departure time listed at any station, as when time is allowed for a passenger work stop, or when a meet is pending, precede the arrival time with the letter "A" (Arrive) and precede the departure time with the letter "L" (Leave). If you have only one time listed for a train at a station, you understand it to be the departure time, so you don't need any clarification -- except: For the first station departure (where the train originates [or enters your layout]), precede the single time with the letter "L", and for the last station where the train arrives (or terminates), precede the single time with the letter "A".

At the top of each column in your timetable put these items: the train class, train identity, frequency (Daily, Mon-Fri, etc.), the train name if any (The Blue Dog), an up or down arrow to reinforce the direction in which you read the timetable for that train, and a column number. Your timetable should also include these unnumbered informational columns: station name, symbols, distance from some base point, siding length for stations with sidings, and hours of operation for manned stations. You can list your symbols and their meanings in your Operator Guide, then print an extract of that page from your guide on the reverse side of your timetable page.

This "system" is complex. But, it paves the way for smooth operating sessions and greatly facilitates restaging, especially for those owners who take advantage of the ability of the waybills to self-stage, or at least guide the restaging process. Owners who restage their own railroad soon develop a "feel" for the railroad that they just can't get any other way. They also become dependent on the system and quickly learn how to take advantage of the behind the scenes manipulations that ensure that their easy to understand train instructions and their easy to follow waybill color schemes contribute to successful and enjoyable operating sessions.

A final thought. Car cards with waybills in them become bulky. Be sure to provide your operators plenty of car card boxes that are large enough to hold a goodly number of cards. I prefer to have at least one box per yard and industry track with lots of extras for temporary use, sorting, and storage of supporting card inserts. I make the box backs 5 inches high and the fronts 1 ¾ inches high in front. As the cards are 2 1/8 inches wide, I make the boxes 2 ¾ inches wide (inside dimension) to provide ease of inserting and removing the cards without damage or cramming. Finally, I make the boxes at least 1 ½ inches deep -- enough to hold a stack of about 25 cards without forcing. If you run trains longer than 25 cars, you may want to make the boxes even deeper, or instead, use two boxes for each train in staging areas.

The people who use this system have contributed numerous suggestions and tweaks to help improve it to the point that it is at today. Many thanks to these following operating model railroaders who use this system during their regularly scheduled operating sessions and who have permitted me to use samples of the paperwork from some of their systems to support this discussion:

Name	Residing in	Principal Railroads Modeled	Implementation
Don Bell	Pennsylvania	L&N, IRR, (SOU, N&W, CRR)	Full
Jim Hertzog	Pennsylvania	RDG, (LNE, CNJ)	Partial
Lew Jones	Pennsylvania	Conrail, AMTRAK	Full
Larry Reynolds	Pennsylvania	PRR	Full
John Rogers	Pennsylvania	MEC, CP, (B&M, SJLC)	Full
Gale Smith	Pennsylvania	LVRR, (RDG, LNE, CNJ)	Full
Jeff Warner	Pennsylvania	WM, RDG, PRR	Full
Kent Williams	California	OWNRY, SP, UP, GN, SP&S, NP	Full

BY DIRECTION OF THE MandY PRESIDENT:

Raymond W. Fisher
Vice President Operations
NMRA L-5811, MER L-327