LOCOMOTIVES

A locomotive is the non-revenue machine used to propel cars about the railroad. Broadly speaking, locomotives can be divided into two categories, those that get their energy from steam, and those that get their energy from electricity.

Steam locomotives carry water, which is heated into steam by either a coal, or rarely bunker oil, fueled fire. The steam is fed into pistons, which turn the drive wheels. Electric locomotives pull their power from external wires (a popular choice in Europe), or generate their electricity internally using diesel, or rarely gasoline, powered generators (a popular choice in North America). The electricity is fed into electric motors, which turn the drive wheels.

A locomotive is chosen for duty by first the load it can pull, and secondly by the speed it can achieve. The torque vs horsepower tradeoff means that locomotives geared for slower speeds can pull more cars than their faster counterparts, yet a faster locomotive may be necessary to, for example, get those bananas to market before they spoil. Higher power locomotives also require more fuel, so it is important to try to always use the most fuel efficient locomotive (usually meaning lesser power) that will get the job done. Railroads will also try to minimize the time a locomotive sits idle. This means that sometimes a type of locomotive you wouldn't expect might be temporarily relocated to the area, or be assigned to an out of the ordinary job (such as a "passenger" locomotive pulling a freight train).

Real Railroads

Before the second world war steam locomotives were dominant, primarily because the real railroads owned their own fuel coal mines (prior it was a technology issue). Later it became cost effective to use diesel-electric locomotives, because of the combination of inexpensive diesel fuel and the lower associated maintenance costs for diesels. Had the price of diesel fuel been higher however, railroads might still be using some steam.

Locomotives are heavy, because weight helps with traction. However a lot of wheel weight means heavier rail is required. One way to spread out the weight, so lighter track and thinner ballast can be used, is to have more wheels. This is why locomotives designed for branch line use will sometimes be found with more drive wheels than their main line equivalents, even though more wheels increases maintenance costs.

American track was built to low standards, so early steam locomotives often had derailment problems. The solution was to add four guide wheels to keep the locomotive drive wheels on the rails. As tracks improved, slower running locomotives could safely reduce the guide wheels down to two, or even none. Note that the wheel design of diesel locomotives act as both guide and drive wheels. All the while fireboxes increased in size in order to produce more steam, and thereby power. To accommodate the extra firebox weight first two, and later four, trailing wheels were added to steam locomotives.

Although small steam locomotives can carry their water and fuel supply on the locomotive itself, larger locomotives will pull both behind them in a supply tender. Note that water is used up faster than fuel. Because diesel generators only require fuel and not water, diesel-electric locomotives have enough space to carry all their fuel onboard. Both locomotive types also carry sand, which is dropped on the tracks for extra traction.

Diesel locomotives used in cold weather passenger service before the 1960's also had to be equipped with a water tank and a steam generator, so they could heat the radiators on passenger cars (radiators were used because the then common steam locomotives had a readily available source of steam). Passenger cars are now equipped with electrical heaters, so the need for steam generators in diesels has disappeared (but conversely, passenger duty steam engines must be fitted with steam powered electrical generators).

"Pilots" are installed on freight and passenger main line locomotives to sweep large track debris out of the way. Locomotives primarily assigned to switching duties usually replace the pilot with footboards, for use by the forward brakeman while cars are being shunted. Locomotives must also be fitted with a headlight and marker lights. By union rule until recently, all diesel locomotives over 44 tons had to carry both a fireman and an engineer, regardless that there wasn't any fire that needed stoking by a fireman.

Toy Trains

There are several ways that toy trains have been powered over the years, and the three rail legacy is a direct result of one such scheme. Unfortunately, because the schemes are not compatible, it is important to decide on the powering method prior to acquiring your locomotives. For this reason it is highly recommended that you do *not* invest in a powered locomotive until after you have first acquired a collection of cars and have laid some of the track for the layout. By then you will have a much clearer idea of what scheme you will need to employ, and can purchace new or retrofitted locomotives of the appropriate type. Until that time you can instead acquire a cheap unpowered dummy locomotive, then push it about by hand on your layout in order to test out your track plan, building clearances, uncoupling points, and other layout construction issues.

Steam locomotives require large quantities of water for boiling into steam, external cumbustion fuel to heat the water(originally wood, but later and most commonly coal, although sometimes heating oil), and sand for extra traction. At the end of their short work cycle, they require a place to dump their wood or coal ashes, and a building where lubricating and other major maintenence services can be performed. Both a driver (known as an Engineer) and a fire stoker (known as a Fireman) are required.

Electric locomotives require a source of electricity, either from wires or from an internal generator, a source of fuel for an internal generator (almost always diesel, but sometimes gasoline), and sand for extra traction. At their end of their much longer work cycle, they require a building where minor maintence services can be performed. Only an Engineer is required, although a Fireman may also have to be carried by rule.

Because steam locomotives require extra facilities not needed by diesels (ash pits, water towers, coaling towers, etc.), take up more layout space due to the need to carry tenders, have difficulty in shunting duties, and are not inherently bi-directional; it is recommended that small to medium sized layouts only use diesels for local trains.

Unless only numbered (or rarely named), a locomotive will also bear the owning railroads logo. Unfortunately, many toy locomotive types are only labeled with a few railroad names. One could assume our railroad pools equipment with other railroads in the region, but that still leaves many gaps. Therefore, since we are more concerned with the locomotives job than its paint scheme, it is suggested that we simply ignore the labeled road name, and mix-n-match road names from different regions of the country, or even include fantasy road names such as "Lionel". It matters little what era the locomotive was built in (as long as it is not still wood fueled), or even if a justifiable locomotive wheel arraingement never existed in real life (i.e. the Lionel steam engines), because with only a minor stretch of the imagination, we can make the case for an older steam or diesel locomotive to still be at work. What *is* important though is that a specific locomotive type (i.e. GP7, RS-2, etc.) with the SAME road name have a different cab number, so that the hostler can uniquely identify each locomotive on the layout (a hostler is a mechanic who moves a locomotive from maintenance to its job location).

Medium horsepower "road switcher" locomotives are versatile, and require minimal layout space. For most layouts the BL2 or GP7 locomotive types make a great choice. At least one of your switching locomotives should have a coupler on both ends, but it is preferable if all of your locomotives have automatically operated couplers on both ends.

Layout Ideas

A diesel-electric locomotive can operate for several days before it needs to be inspected, oiled, and have its sand replenished. Since play sessions rarely assume a time span exceeding 24 hours (by rule, train crew work hours are limited to 16, and more recently, 12 hours), we can pretend that the locomotive was fully serviced just prior to the start of play. Diesel fuel might have to be added sometime during the play session, but it is not necessary to have a dedicated fueling facility. A refueling truck can drive right up to the locomotive, even while it is standing on the main line, and refill the fuel tank.

If several locomotives are available for use by a train, choose an appropriately powered one based on the "**Locomotive_Selection_Matrix.pdf**". If your chosen locomotive couldn't realistically move the entire train, break up the train and move it in sections, either by coming back for the other sections later, or by assigning other locomotives to pull the remaining sections behind the first section in convoy fashion. By rule, no other train may operate in between sections of a train, regardless of the gap between sections. This is one of the reasons why all model railroads should have a train shedule (sometimes called a "timetable"). Remember, it isn't the locomotive that constitutes a train, but rather a number assigned on the railroads daily train schedule (if more trains are needed that day, extra train numbers will be added, and if less are needed that day, already scheduled train numbers will be scratched).

The air brake reservoir tanks on all rolling stock require charging-up from the locomotive air brake compressor. Whenever you couple a car onto a train, pause for just a moment before moving the car to simulate this tank pressurization process.