Sid Meier's

RAILROAD TYCOON

MICROPROSE™
SIMULATION • SOFTWARE

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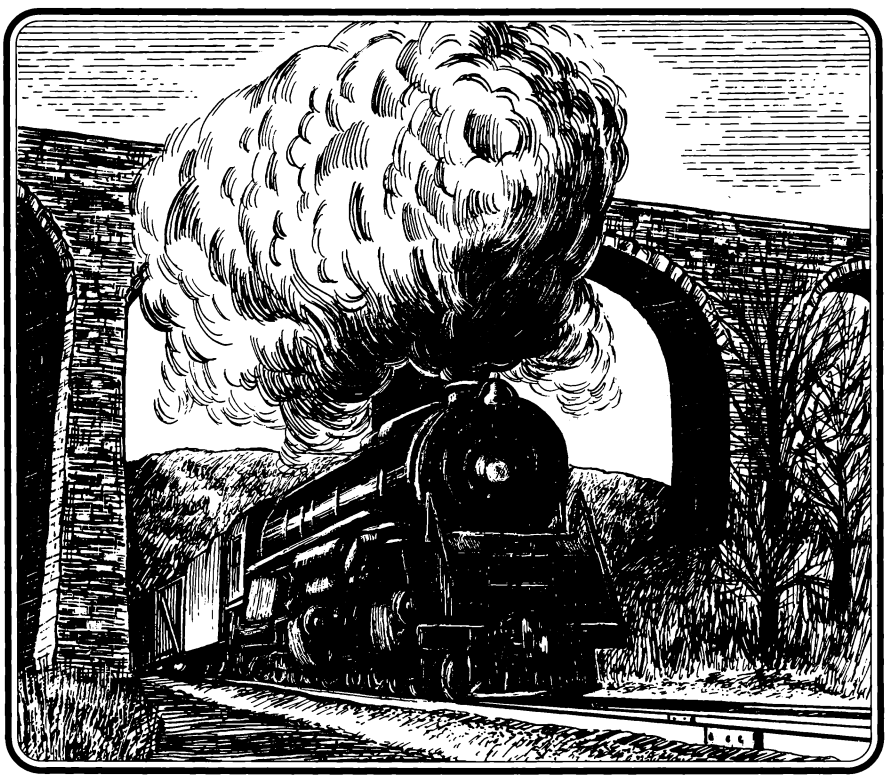

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RAILROAD TYCOON
Computer Simulation

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1 INTRODUCTION

INTRODUCTION

Railroad Tycoon is a game about the fascinating world of railroads: steel tracks stretching to the horizon, promising adventure and romance; steam, diesel, and electric locomotives, some of the largest machines man has ever built; nations transformed by the speed and strength that locomotives could achieve, eclipsing the puny power of man himself and the animals he could domesticate; the sounds of steam whistles, diesel horns, and clanging bells; a world of risk - natural disasters, poor economic times, and rival railroads; and a world of opportunity - money, prestige, and fame.

Railroad Tycoon puts you into this world as the president of a tiny railroad enterprise. Your railroad empire is only a dream, but you have a little money from investors and your own ability to start with. Your task is to carve your railroad empire out of this great world of opportunity.

In Railroad Tycoon, you, the player, construct and operate a complete railroad, from tracks and signals to locomotives and livestock cars. If you successfully manage your resources and make them grow, you can expect a long professional life of railroading achievement. However, you are not alone in the world and other men possess the same dream as you.

Your skills as a tycoon are tested by competing railroads run by men such as Commodore Vanderbilt, James Hill, and J. P. Morgan, determined to crush you or brush you from their path. Running your own railroad well is not going to be enough if your competitors do better, or raise the money to take you over.

You begin Railroad Tycoon by choosing one of four different world maps to play on: Northeastern America (1830), Western North America

(1866), England (1828), or Central Europe (1900). The date in parentheses indicates the historical year in which the game starts. Each region has its own geography, economic opportunities, and locomotive technology.

These four worlds were chosen for their specific interest or railroad history. England was the scene of the beginnings of railroading. The Northeast United States witnessed the beginning of railroading in America, and fostered many of the world's most famous railroads. The Western USA was the site of some of railroading's greatest construction efforts, the building of transcontinental railroads. Europe remains very railroad oriented, and France is running some of the fastest trains in the world.

Each new world map is empty of railroads but full of the opportunity to earn money hauling freight and passengers. You must parlay one million dollars of loans and stockholder investments into a functioning, revenue earning business. If you dawdle or make too many mistakes, expect to be forcibly retired by irate stockholders or see your company gobbled up by a competitor.

You simultaneously wear the hats of construction superintendent, master of the road, dispatcher, chief financial officer, and chief executive officer. You decide where to lay tracks, what types of trains to put in service, when to schedule trains, where to change the types of cars in a train, when to upgrade equipment, where to add facilities, where to encourage industry, and how best to finance expansion and improvements.

At any moment in the game your attention can be directed to several places: to find the best route for expansion toward a new city, to examine the maintenance costs of your locomotives to see if any are getting too high, to scan Shipping Reports to see if one cargo or another is piling up enough to justify another train, to look for new industries springing up in areas where you can provide service.

To succeed you must balance the investment of your limited funds between more construction projects, adding more trains, adding more facilities, and stock purchases. Profitable investment decisions increase your revenue and make possible further expansion

and service improvements. But keep your eye on the stock market to see what your competitors are up to and don't let them ambush you.

Competing railroads are operated by their presidents in the style of their historical personality. Expect a road run by Jay Gould to look for stock market profits and take every opportunity to raid your stock. Jim Hill can be expected to build an extensive and profitable system. Beware of his propensity to quickly grab access to profitable areas, blocking you out if possible.

Competing railroads can be attacked operationally by building tracks into their stations and starting rate wars. The railroad that does the best job of providing service to the city is given a monopoly on local service by the city council. The loser must withdraw from the city, forfeiting his investment in track and stations. By this tactic you can reduce the earnings of competitors and continue your expansion.

Alternatively, you may invest in the stock of competing railroads and possibly take them over. If you get control of another railroad, you can direct its finances and expansion, using it to help your road or block competitors.

Your ultimate goal as a Railroad Tycoon is to run the most profitable railroad that you can and retire to a prestigious position, perhaps even becoming President of the United States. If your railroad is sufficiently profitable at your retirement you may be enshrined in the railroader's Hall of Fame.

If you aren't able to make the grade as a railroad president, you may be able to find work as a snake oil salesman or circus impresario.

Table Of Contents

7. Notes And Credits

What is a Railroad

Consider a railroad operating between Baltimore and Philadelphia. The railroad has laid a single track between these cities, setting up stations at each city where cargo can be put on trains and taken off. The railroad also purchases a locomotive and some freight cars. It advertises service between these cities leaving Baltimore at certain hours and arriving in Philadelphia roughly an hour after leaving Baltimore. Return trips are also scheduled from Philadelphia and take about an hour to reach Baltimore.

Businesses in either city have the ability to use the railroad to ship goods back and forth. Whether the railroad is used for shipment or not depends on the relative cost, safety, and timeliness of railroad shipment versus alternative shippers (trucks, ships, airplanes, etc.). This Baltimore & Philadelphia Railroad (the B&P) can only draw business by providing the required service at attractive prices, and thereby staying competitive with other transport modes.

Once the B&P has started carrying cargos, it must balance its expenses and revenues to remain in business. The start-up costs of the railroad are the land it had to purchase to place its tracks, the cost of track construction plus any bridges or tunnels required along the way, station facilities, maintenance facilities, its locomotive and freight cars. All of these items plus operating personnel must be in place before the first train can run.

After operations begin, the railroad has to provide fuel for the locomotive, maintenance expenses for equipment, and salaries for the work force. The revenue earned by the railroad must be sufficient to cover the expense of construction, operation, and provision for the future.

For the B&P, the future may mean upgrading stations, buying additional locomotives and cars to carry more freight, double tracking the line so trains can simultaneously run in both directions, building signal systems so that multiple trains can run on the same track without colliding, freight yards, new car types for special cargos, etc. Railroads must constantly evolve because technology and service demands are changing and they must adapt to remain competitive.

All railroads, regardless of their size, are composed of three elements linked together for one function. Track, locomotives, and cars are combined to move people and things from one place to another.

The strengths and efficiencies of a railroad come from the elements that make it up and how they work together. Tracks make it possible for enormous loads to be supported, guided, and moved at one time. The cars are designed to carry specific cargos, for ease of loading and unloading, and for safe movement in combination. The locomotives make the railroads go. Supported and guided by the tracks, they can pull long trains of loaded cars at relatively low cost.

A railroad train is made up of a locomotive, or source of motive power, and the cargo cars lined up behind it to be pulled. The types of engines and cars that make up the train are called the *consist*. For example, a train *consist* might be a single 1500 horsepower (hp) locomotive and 20 coal hopper cars.

In a typical railroad operation, a crew of three or more men (engineer, conductor, brakeman, etc.) are assigned a locomotive and a train to pull. The crew takes the locomotive from the engine house out to the departure yard and connects up to the waiting train previously assembled by the yard crew. The conductor checks the train against its manifest to be sure everything is in order and okays movement. Following train orders from the dispatcher, the crew begins its trip, pulling the train from the yard out onto the track of the mainline.

On the mainline the engineer takes over, controlling the speed of the train according to speed limits posted along the right-of-way, watching the signals that additionally govern movement and speed in each block, watching the track ahead for obstacles, making proper horn signals at crossings, and monitoring the performance of the locomotive. The brakeman's duties on the road are mainly to watch the train itself, looking out for smoking wheel bearings or other conditions that might result in an accident.

At the end of its run, the train pulls into the receiving yard of another terminal and the crew uncouples the locomotive from the cars. They head to the engine house for maintenance and refueling of the locomotive, while the train is turned over to yard crews who break up the train and place the cars into other trains that take them on to their destinations.

Railroads earn their money by being paid to move things. In the case of freight goods, the railroad and shipper make arrangements for the cargo to be loaded into a freight car. The railroad then arranges for the car to be picked up and added to a passing train. This train pulls the car towards its destination, perhaps directly there, perhaps only to a rendezvous with another train which carries it on farther. Ultimately the railroad brings the car to its destination where the receiver of the cargo arranges to get the goods out of the carrying car.

The railroad is paid a fee for the delivery. This fee is normally prearranged and paid upon delivery within a reasonable period. Because a late or damaged delivery may reduce the fee or drive business to alternative transportation modes, railroads must be operated safely and according to schedules which assure timely service.

Railroads today generate most of their revenue and profits from hauling large, heavy trains over long distances. In this role they continue to be the most efficient carrier. The purpose of most railroad operations is to get freight into and out of these long trains quickly and safely.

Railroads came into existence because their technology offered transportation at speeds and costs previously unimagined. They continue to prosper today, despite competition from other transportation modes, because in certain situations they are clearly more efficient than any alternative.

BEFORE YOU START

Sorting the Materials

This Manual provides detailed instructions on how to play and information on the background of railroad construction, operation, and finances. The manual text is printed in two main type faces, normal and *italic*. Text in normal type usually discusses specific instructions. Text in *italic* type is usually a commentary on the information discussed in normal type. When you are looking for specific information in a manual section, look first in the normal type parts. The manual applies to all computer systems.

The Technical Supplement gives specific instructions for loading and/or installing the game on your computer. It also provides a complete reference of all the graphics and keys used in the game.

The Player Aid Cards offer a handy reference for the economic relationships of the various industries and geographic features on the individual region maps.

Installation

The Technical Supplement has complete information about how to install Railroad Tycoon on either floppy or hard disks.

Learning the Game

Study Method: You can study the actual controls and instructions in this manual (pages 3-113). Begin by reading through the Interface Introduction (pages 13-15), Pre-Game Options (pages 16-19), Reading And Using The Displays (pages 20-31), and the Tutorial Railroad (pages 35-47). Now begin play and refer back to the instructions as needed.

Jump Right In Method: This is the most popular with experienced computer game players. We recommend you at least read through the Interface Introduction, Pre-Game Options, and Reading And Using The Displays, but even this is not necessary. Refer to the manual's instructions for help with problems that arise.

INTERFACE INTRODUCTION

The interface of Railroad Tycoon was primarily designed to take advantage of the mouse. It may be played with either a keyboard interface or a combination keyboard/mouse interface, but play is faster if you have a mouse available.

Throughout this manual there are references to certain keys, the *Selector*, *Selector 1*, and *Selector 2*. Because the manual is written for all machine formats you need to refer to the Technical Supplement to learn what these keys or buttons are.

The interface relies heavily on menus. At every point where you can perform game functions there is a menu bar available from which menus can be accessed.

Opening Menus

Throughout the manual you are instructed to pull down menus to open them up and reveal the options they contain. To open a menu using the mouse, place the mouse pointer on the name of the menu in the menu bar and press *Selector 1*.

You can also pull down a menu by pressing the keyboard letter key for the first letter in the name of the menu. For example, the Game menu is opened by pressing the *G* key.

When a menu is opened, the choices it contains appear listed in a menu window.

Menu Types

In Railroad Tycoon there are generally two types of menus. The most common is simply a list of choices from which you choose the one desired. Making your selection usually closes the menu and implements your choice at the same time.

In the second type of menu, the options are either toggled *on* or *off*. Options that are *on* are noted by a check mark. Options that are *off* have no check mark. To exit these menus press *Selector 1* outside and below the menu or press *Selector 2*.

Menu Choices

To make your choice of the options available using the mouse, place the mouse pointer on your selection and press *Selector 1*.

Alternatively, you can open a menu by placing the mouse pointer on the menu name, pressing and holding down *Selector 1*, and dragging the mouse pointer down from the menu name. As you drag the pointer down the length of the opened menu, its options are highlighted one by one. To select an option, drag the pointer down until the option of your choice is highlighted, and then release *Selector 1*.

If you don't have a mouse, you can make selections from a menu by using the *Direction* keys to move a highlight bar up and down the menu until the choice you want is highlighted. Then press the *Selector 1* key to make your choice. Note that in most menus the highlight bar does not appear until you press a *Direction* key, usually the one that moves downward.

When you are using the mouse, if you have opened a menu and wish to make no choice, you can accomplish this by either moving the mouse pointer below the menu and pressing *Selector 1*, or just by pressing *Selector 2*.

Shortcut Keys

Even when using the mouse, there are places when one key can save several steps. Included in the interface are several of these shortcuts, described in the Technical Supplement. These keys are normally accessed with the left hand, leaving the right hand free to use the mouse.

Map Scrolling

When playing Railroad Tycoon, you spend most of your time viewing one map display or another. In order to be able to move around the various maps you need to understand how to scroll whether you use a mouse or the keyboard.

If you are playing with a mouse, move the mouse pointer to any part of the map visible, and press one of the following: S*elector 2*, the *Center* key, or the shortcut key for the display map that you are on. The map immediately centers on the position of the pointer.

If you don't have a mouse, a cursor is usually present on the map display. (If not, press the *Tab* key to get it back on the map.) Use the *Direction* keys to scroll the cursor around the map. If you go off the map edge, the map is redrawn if possible, centered on the cursor's new position. Rather than move the cursor off of the map edge, you can move it to any position on the map and press either the *Center* key or the shortcut key for the display map that you are on. The map immediately centers on the position of the cursor.

Zooming and unzooming from the various map displays is explained in Reading and Using The Displays, page 20.

PRE-GAME OPTIONS

The beginning of a game of Railroad Tycoon requires you to make a number of choices regarding the parameters and location of the game you wish to play.

To begin a game of Railroad Tycoon, follow the instructions in the Technical Supplement for booting the game. After the title and credit screens, you may be required to answer a few technical questions regarding your hardware, depending on the machine format you are using. You then proceed to the selection of pre-game options.

Game/World Options

The first menu that appears asks you to choose which game to load:

"Start New RR"
"Load Saved RR"
"Load Tutorial"

Choose "Start New RR" to begin a new game. Choose "Load Saved RR" to load a previously saved game. A menu of your saved games appears and you choose the one you wish to load. Choose "Load Tutorial" to load the tutorial railroad.

The next menu asks you to choose the world you wish to play in:

"Eastern USA" (begins in 1830)
"Western USA" (begins in 1866)
"England" (begins in 1828)
"Europe" (begins in 1900)

Difficulty Levels

You are next asked to choose the level of difficulty at which you wish to play:

"Investor"
"Financier"
"Mogul"
"Tycoon"

The Investor level is the easiest level to play and the difficulty increases as you move down the list. The level of difficulty affects how much revenue is earned by each delivery and the number of years you can play before you must retire. At the Investor level you can play 40 years, at Financier- 60 years, at Mogul- 80 years, and at Tycoon- 100 years. At the end of the period when you normally must retire, you may

have the option of increasing your level of difficulty in order to continue playing.

In addition to these effects, the level of difficulty chosen also affects your tycoon rating when you retire, as explained below in the section on Difficulty Factors.

Reality Levels

After you have chosen the difficulty level, you are then asked to set the level of reality at which you wish to play. A menu appears with three reality levels listed:

"No Collision Operation/Dispatcher Operation"
"Friendly Competition/Cut-Throat Competition"
"Basic Economy/Complex Economy"

This menu differs from most others in that each option is actually a toggle between two choices. The option that is shown in the menu is the active option of each pair. If you choose an option, that option is turned off and is replaced by the other one of the pair.

If the menu currently lists "No Collision Operation", then the game is set to run in the No Collision Mode (see page 93). If you choose the "No Collisions" option from the menu, that turns on the "Dispatcher Operation" option and the game is set to play with more complex train operations. In this case, the movement of trains is controlled by block signals, and collisions are possible (see Operating Trains, page 88). New players should choose No Collisions.

If the competition is friendly, they do not buy your stock, attempt to take you over (see Stock Market Takeovers, page 111), or start rate wars at your stations (see Rate Wars, page 109). If the competition is cut-throat, they aggressively buy your stock, try to take you over, and start rate wars to capture your stations. New players should keep the competition friendly.

In a basic economy every station serving a moderate size city demands all cargos. This makes it easier to make money, because any cargos that you can pick up can be delivered to any city station. In a complex economy the demand at a station is determined by demand of the industry and community it serves (see Railroad Stations, page 56). New players should play with a simple economy until comfortable with the concepts of supply and demand.

For each of the reality levels, choosing the easier option makes the game easier to play by dropping out some concepts a new player then doesn't have to think about. As you get more familiar with the mechanics of the game and the decisions that must be made, you can selectively increase the reality level of your games.

In addition to making the game more or less easier to play, setting the reality level has an effect on the difficulty factor explained below.

The Difficulty Factor

The difficulty factor is a measure of the degree of difficulty that you have set for your game. When you retire or are forcibly retired, the difficulty factor helps to determine your retirement bonus and tycoon ranking. The difficulty factor is a percentage, from 25% to 100%, and the higher the percentage, the higher your ranking is, other things being equal.

The difficulty factor has two general components, the levels of difficulty and reality that you have set for your game. Each level of difficulty has a difficulty factor value.

To these factors are added the factors from each of the reality levels. The easier levels of reality have a 0% difficulty factor. The difficult levels of reality are each assigned a number of difficulty factors that are added to your total when selected.

When you are setting the level of reality for your game, the Difficulty Factor window is also visible. Within this window is displayed the current difficulty factor of your game, ranging up to a maximum of 100%, and set at first by the level of difficulty that you have already chosen. As you adjust the reality levels, you can see the difficulty factor changing with each adjustment.

New players should start with a very modest reality level. A difficulty factor of 100% is achieved by playing at the tycoon level with all three of the difficult reality levels turned on. This is the ultimate Railroad Tycoon challenge.

The effect of your difficulty factor on your retirement bonus reflects the number of jobs you took on as president of your railroad. If you additionally acted as your railroad's dispatcher, had to battle much fiercer competition, and acted as your railroad's shipping agent, then your bonus is going to be larger.

When you are satisfied with the reality levels that you have chosen and the difficulty factor that results from your choices, press the *Selector 1* key, or *Selector 2* if using the mouse, to proceed.

This ends the pre-game choices you need to make to begin play. At this point the map is drawn and mountains, resources, and cities are added to complete the world for your game.

As prompted, press any key to begin play.

RR President's Aptitude Test

Before you are actually accepted for the job as president of the new railroad being formed, you must pass one simple test. A window appears showing one large locomotive and a list of possible identities for it below. You must correctly identify the locomotive pictured. If you need some help, you can refer to the Locomotive Roster, beginning on page 151 of this manual.

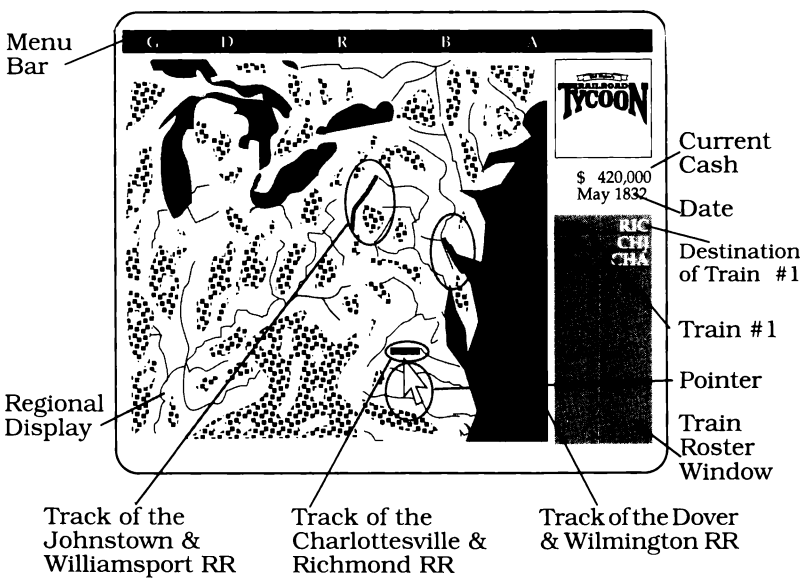
If you fail to correctly identify the pictured locomotive, your future as a railroad president will be severely handicapped.

READING AND USING THE DISPLAYS

After you finish choosing the pre-game options, the game opens at the Regional Display. The main feature of this display is the world map chosen for this game shown in the display window. The other important features of this display are the Menu Bar, the Train Roster, the date, your railroad's current cash, and the World View window. These features are found on the other displays as well.

You spend the majority of the game playing from the displays, and you need to understand what you are seeing and how you can perform game functions from these displays to play well.

Regional Display



The Regional Display

This display shows the entire world chosen for your game. In the case of the Tutorial Railroad, from which the above illustration comes, the game world is the Eastern USA. You should be able to recognize the rivers and coastlines. Refer to the Technical Supplement to learn what the different colors that are visible on land represent.

This display gives you the complete picture of the world. It shows the basic geography, including the location of mountains and rivers, and also indicates centers of population. If railroads have started operating, they are visible as well.

From the Regional Display you can pick out likely areas to consider building your railroad. Normally this is an area where at least two good sized cities are close enough together to make building a railroad between them a reasonable proposition.

The Menu Bar

Across the top of the entire window is the menu bar. From here you gain access to a number of menus from which you can change game parameters, save games, jump to other displays, read railroad reports, build railroad equipment and structures, and perform other game functions. In the following sections, the individual menus that are found on the menu bar are described in detail.

The Game Menu

When opened, the Game menu consists of 5 options:

"Game Speed"
"Train Messages"
"News Reports"
"Repeat Message"
"Save Game"

You can open this menu and make choices from it at any time during the game. The 5 possible options have these functions:

Game Speed: Choose this option to vary the speed of the game. A new menu opens listing the 5 game speed options:

"Frozen"
"Slow"
"Moderate"
"Fast"
"Turbo"

Choose "Frozen" to completely stop the passage of time. This allows you to examine geography, build track, place stations, etc., while all trains and activities of competing railroads are halted. In addition, although you may call your broker, he won't answer until time starts moving again.

"Slow", "Moderate", and "Fast" are simply relative scales of time, each faster than the other with no additional effect.

"Turbo" speed is another special case, that not only triggers the fastest passage of time, but the game does not pause as is normal for any messages or end of year fiscal reports. The game just continues playing at top speed with no stops.

Train Messages: This option refers to the train arrival announcements that appear in the World View window at the top right of the display. Normally a report appears in this window each time a train arrives at a station. This report lists the number of the train, where it has arrived, the time of arrival, what cargos are delivered, and the revenues earned by the delivery. By choosing the "Train Messages" option, you open another menu that gives you the choice of turning off these messages, or having them go away fast or slowly.

News Reports: Choosing this option opens another menu from which you can set the type of news reports you wish to receive. From this menu you control the presence of the reduced sized newspaper reports that appear from time to time. If you are getting the information, the option has a check mark next to it. If you have the option turned off, the check mark is missing. Your options are:

"Financial News"
"Railroad News"
"Local News"
"Animations"

•Financial News: These are mainly reports on the financial activities of competing railroads, specifically the stock that they are buying and selling. You do not receive news of their bond sales and purchases unless the competing railroad transacting bonds owns stock in your railroad.

•Railroad News: These are reports on the non-financial activities of the competing railroads, such as the start up of a new railroad, and the building of new stations and track.

•Local News: These reports refer to events on your railroad such as the presence of a Priority Shipment or a change in the local supply or demand due to the loss or addition of industry (only when playing with a Complex Economy).

•Animations: Certain events in the game such as bridge building and train wrecks are marked by an animated graphic sequence. You

can turn off these animations to speed up the game.

Repeat Message: If you were not able to read the last message that appeared, you can choose this option to have the message repeated.

Save Game: The game you are currently playing is saved at the moment you make this choice. You are asked which of the 4 saved game files you wish to place the saved game in. Thereafter, this game can be called up again and play resumes from the exact moment when you saved it. If you choose to write the saved game into a file that holds a previously saved game, the older game is eliminated.

The Display Menu

The Display menu consists of 5 choices:

"Regional Display"
"Area Display"
"Local Display"
"Detail Display"
"Options"

This menu is used to zoom in or out among the displays, or to change the information shown on the displays. The Regional Display is the farthest zoom, and the Detail Display is the closest zoom. How best to zoom from this menu depends on whether you have a mouse or not.

If you do not have a mouse, use the *Direction* keys to center the cursor box in the area of the map now visible where you wish to zoom, regardless of direction. Pull down the Display menu and choose the display to which you want to zoom. The new display centers on the cursor.

If you have a mouse, pull down the Display menu and choose the display option you wish to see. You are prompted to "Click on map center". Place the mouse pointer in the area of the current display to which you wish to zoom and press *Selector 1*. The new display centers on the mouse pointer.

Alternatively, the shortcut keys shown on the menu can be used with either the mouse or keyboard interface. To use the shortcut keys, center either the cursor (when using the keyboard) or the mouse pointer (when using the mouse) in the area you wish to examine, and

press the shortcut key specific for the display you wish to see. The new display centers on the area you marked.

Options: By choosing this option, you open another menu from which you may toggle on or off information reported on the displays. The information that can be toggled on or off are the Shipping Reports and the Resource Map. If the information is on, the option has a check mark next to it. Information toggled off has no check mark.

•Shipping Reports: If checked, Shipping Reports are visible from the Area and Local Displays (see Shipping Reports, page 58). If not checked these reports are removed.

•Resource Map: If checked, this option converts the Area and Local Display maps to Resource Maps to help you find nearby sources of cargo supply and demand (see Resource Map, page 83). If not checked, the normal Area and Local displays appear.

The Reports Menu

The Reports menu consists of 7 choices:

"Balance Sheet"
"Income Statement"
"Train Income"
"Stocks"
"Accomplishments"
"Efficiency"
"History"

Choose the option you wish to examine, and the report opens. Each of these reports is explained in more detail elsewhere in this manual, but a short description is included below.

Balance Sheet: A financial statement from your railroad that shows its current condition in terms of assets, liabilities, and the retained earnings, or profits over its lifetime. (See Balance Sheet, page 99.)

Income Statement: Another financial report showing your railroad's revenues and expenses, both for the fiscal period to date, and lifetime of the railroad. (See Income Statements, page 101.)

Train Income: A list of every train running on your railroad and information about that train, especially the revenue it has earned so far this period and in its lifetime. (See Train Income Report, page 101.)

Stocks: A graph that plots the prices of your stock and the stock of the competing railroads. (See Stock Price Graph, page 102).

Accomplishments: A list of the major accomplishments by your railroad including when it was founded, new stations, record revenues, etc.

Efficiency: A report on how efficient your railroad is in picking up cargos waiting at stations, how full your trains are kept, the revenue you are earning per car, etc. (See Efficiency Report, page 104.)

History: A graphic recreation of the growth of your railroad and your competitors on a year by year basis.

The Build Menu

The Build menu can consist of up to 6 choices, depending on what already exists on your railroad and what display you are currently at:

"New Train"
"Build Station"
"Build Industry"
"Remove Track/Build Track"
"Improve Station"
"Upgrade Bridge"

Each of these build options is explained in more detail elsewhere in this manual, but a short description is included below.

New Train: Available from any display, choose this option to build a new train. (See Building Trains, page 64.)

Build Station: Available only from the Detail Display and only after at least one track section has been laid, choose this option to build a new station on your railroad. (See How To Build A Station, page 58.)

Build Industry: Available only from the Detail Display, choose this option to attempt to build a new industrial site, such as a steel mill, factory, etc. (See Building Industry, page 86.)

Remove Track/Build Track: Available only from the Detail Display, this option toggles between building track and demolishing track. When the "Build Track" option is active, the menu choice available is "Remove Track". When the "Remove Track" option is active, the menu choice is "Build Track". In addition, the color of the Construction Box box changes to reflect the active option, as explained in the Technical Supplement. (See How To Lay Track, page 50, and Track And Bridge Demolition, page 54.)

Improve Station: Available only from the Detail Display and only if the Construction Box is centered over an existing station, choose this option to build improvements at the selected station, such as an engine shop, maintenance shop, post office, restaurant, etc. (See Station Improvements, page 61.)

Upgrade Bridge: Available only from the Detail Display and only if the Construction Box is centered over an existant bridge, choose this option to replace an existing bridge with a better one.

The Action Menu

The Action menu consists of 5 choices, or actions that you as president of your railroad can undertake:

"Call Broker"
"Survey"
"Name RR"
"Reality Levels"
"Retire"

You can open this menu and make choices from it at any time during the game. The 5 possible options have these functions:

Call Broker: Gets you in contact with your stock broker so that you can buy and sell stocks and bonds. You can buy the stock of your own railroad or the stock of a competing railroad. Also through your broker you can direct the operations of any railroads that you control. (See Calling Your Broker, page 97 and Controlling Other Railroads, page 112.) Your broker may not always be able to return your call because he is currently taking calls from competing railroads or because you have frozen time. If you have a call placed, a letter *B* appears to the left of your current cash indicating that your broker will get back to you as soon as he can, and that you don't have to keep calling.

Survey: Available only from the Detail Display, choosing this option calls in your engineers to survey the area visible on the display map. The engineers mark the elevation of the area in order to help you plan where best to lay your tracks to minimize grades. (See Surveys And Grades, page 51.)

Name RR: Choosing this option allows you to give your railroad a new name. A window opens and prompts you to type in the name you desire. In addition to the full name, you are asked for a 3 letter *handle* for your railroad that is used in places where the full name would take too much space. For example, the handle of the Baltimore & Ohio Railroad might be the B&O.

Reality Levels: Choosing this option opens a new menu of the game options that you selected when beginning play (see Pre-Game Options, page 16). You may turn these options on or off from this menu. The reality levels that can be changed are:

•No Collision Operations/Dispatcher Operation: New players should choose No Collisions.

•Friendly Competition/Cut-Throat Competition: New players should keep the competition friendly.

•Basic Economy/Complex Economy: New players should play with the Basic Economy.

Retire: Choose this option to end the game or to see how you are doing at this time. By choosing this option, you receive a report on what your retirement bonus would be if you retired now, and what occupation your performance indicates that you are best suited for. Press *Selector 1* to open a menu that gives you a chance to return to the game or really retire.

The World View Window

This small window is most often used to show you at a glance the part of the world map that is currently shown in the display window. It is also used to display Train Arrival Announcements when one of your trains arrives at a station. (Note that how long Train Arrival Announcements linger in this window, or whether they appear at all can be determined by you from the Game menu, see page 21.)

When the world map is shown within the World View window, a box is drawn around the part of the world that is currently shown in the display window. Since it would not make any sense to show this map when you are at the Regional Display, the Railroad Tycoon logo is shown in the window instead.

Current Cash

The amount of money shown here is the cash your railroad currently has on hand to spend. The color of this number (as described in the Technical Supplement) indicates whether the balance is positive or negative. A negative cash balance is the current amount of short term loans that you have outstanding (see Short Term Loans, page 98).

Date

This is the current month and year of your Railroad Tycoon game. Each game begins in the month of January of the starting year. For example, games in the Eastern USA begin in January of 1830. The end of December in each odd-numbered year ends a fiscal period in the game and you review the financial reports of your railroad at that time. At the end of December of each year, you are charged interest on your bonds and short term loans.

The Train Roster

This roster is a list of your trains, in order, from Train #1 at the top, down to the last train on your railroad (see Train Roster, page 65). From this roster you can tell at a glance the cars currently in a train, whether they are loaded or empty, the train's destination, whether it is currently paused or not, its relative speed, and whether or not it is carrying a Priority Shipment. If a Priority Shipment is available on your railroad, the current reward for its delivery is shown at the bottom of the Train Roster.

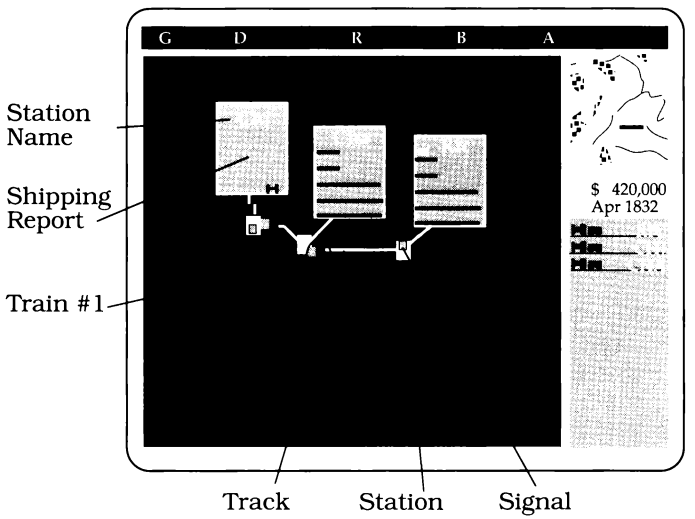
From the roster you can obtain more detailed information about each train and make changes to its route and consist by opening its Train Report (see Train Reports, page 66).

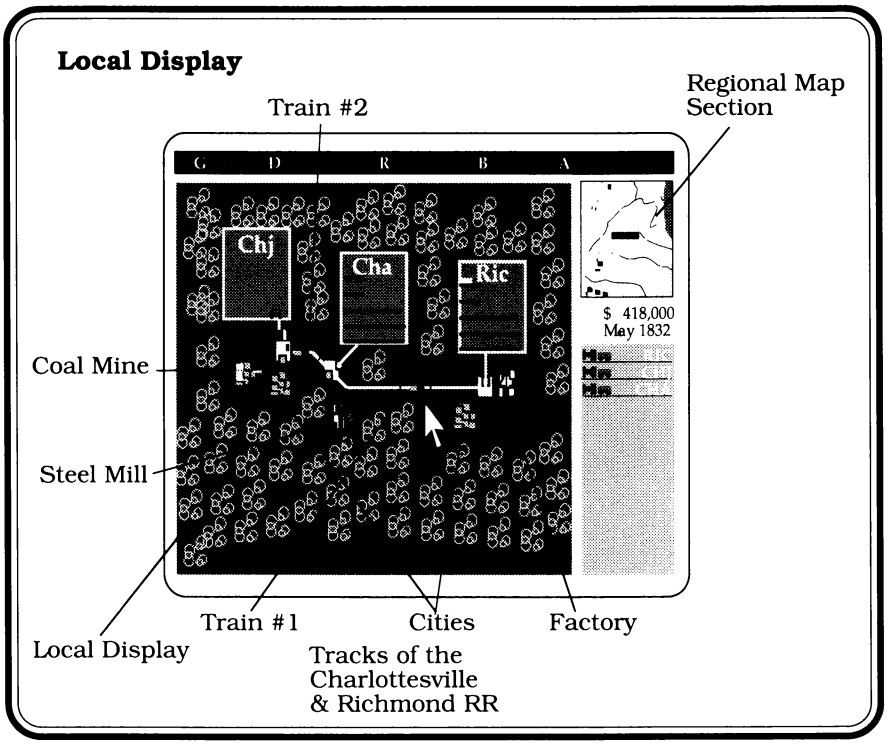
The Area Display

This is the next zoom down from the Regional Display and is a schematic display of your railroad. It shows no geography, but only the track, signals, trains, stations, and Shipping Reports (if not toggled off) of your Railroad. For this display you may toggle off the Shipping Reports (see Display Menu, page 23) and toggle on or off the Resource Map (see Resource Map, page 83).

This display is useful when you want to see more of your railroad at one time than you can at the Local Display. From here it is also easier to pick out the railroad features since the local geography is hidden.

The Area Display





The Local Display

This is the second zoom down from the Regional Display and shows not only your railroad's features, but also the local geography and industry. From this display you can plan the expansion of your railroad into nearby areas with good population centers or industrial sites, while keeping the location of mountain and river obstacles in view.

On this display you may also toggle on or off the Shipping Reports of your stations or the Resource Map.

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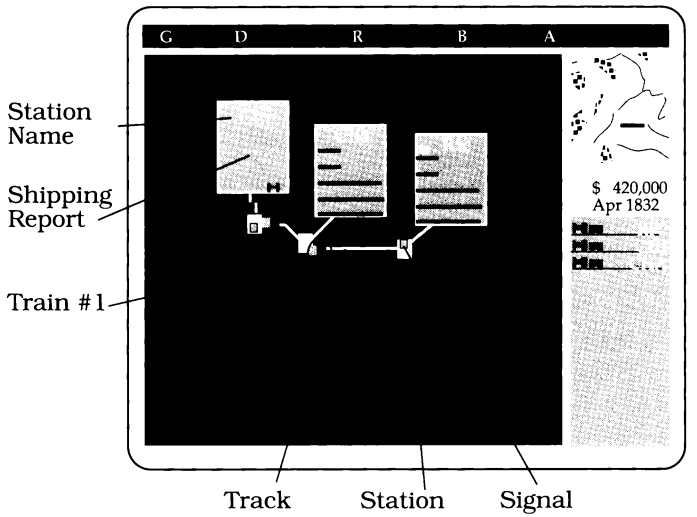

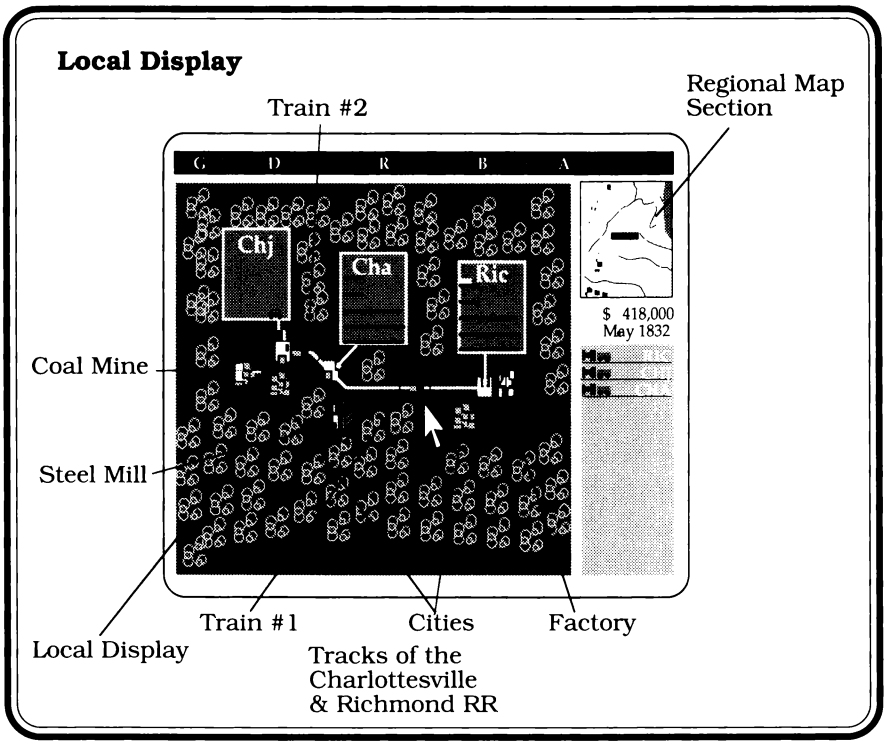

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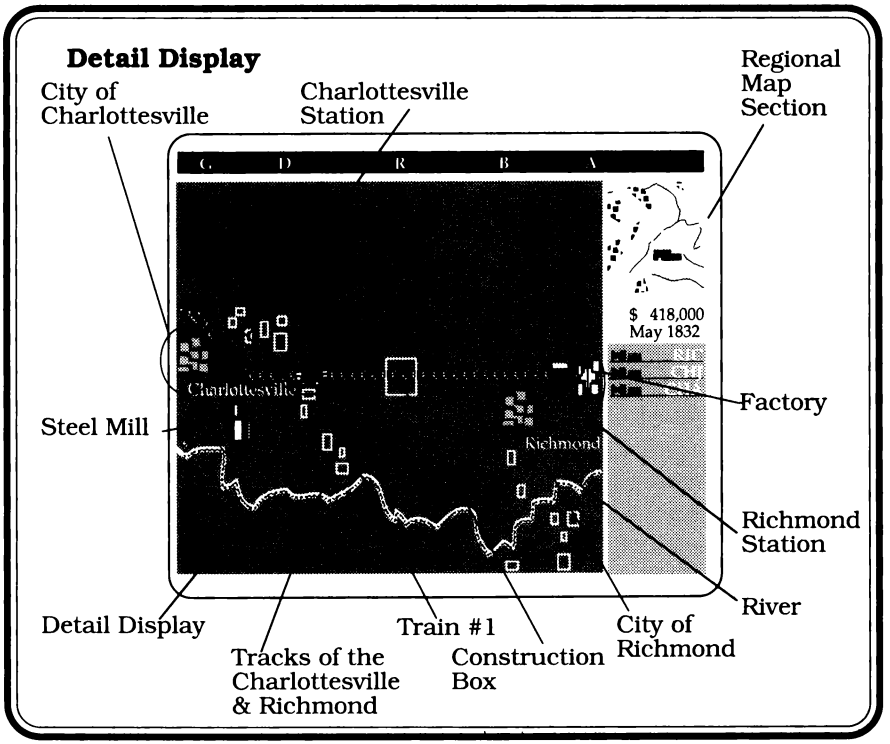
On this display you may also toggle on or off the Shipping Reports of your stations or the Resource Map.

The Detail Display

This is the closest zoom possible, and is the display at which all railroad construction is done. This display shows in greatest detail the geography, population centers, and industrial sites on the map. From this display only, you may survey the local geography and plan in detail the laying of track (see Surveys and Grades, page51).

This display is also the most useful when planning train movements that require the overriding of block signals (see Overriding A Block Signal, page 91), because you get the clearest view of the relative locations of your trains on your tracks.



Ending the Game and Winning

Ending The Game

A game of Railroad Tycoon can end in one of four ways. First, if you are thrown out of office and replaced as president of your railroad by irate stockholders (see Stockholder Happiness, page 96), the game ends immediately. Second, if another railroad manages to buy enough stock to gain control of your railroad, your services are no longer required and the game ends immediately (see Stock Market Take-overs, page 111). Third, when the number of years have passed for the level of difficulty you chose (see Difficulty Levels, page 16), the game ends unless you accept an increase in the level of difficulty. Fourth, you have the option of retiring at any time.

Tycoon Rankings

Regardless of how the game ends, your performance is rated according to several factors, including the value of the railroad when you retired, the number of years that you were president, the difficulty factor of your game, the number of competing railroads, if any, that you control, and whether you were thrown out of office.

The resulting retirement rating is your retirement bonus and final rank as a tycoon, and indicates the job that you are most qualified for after retirement. Post retirement jobs range from Hobo, the worst, to President of the United States, the best. In the final scene of each game you are shown a picture of yourself in your new position.

Throughout play, as you reach new levels of achievement you may receive offers of other jobs. These offers give you a general idea of how you are doing in the tycoon rankings.

Railroader's Hall Of Fame

If you do an exceptional job as railroad president, upon your retirement you may be elected into the Railroader's Hall Of Fame. This is a select group of the 5 greatest Railroad Tycoons. If your tycoon ranking is high enough, you are given the opportunity to add your name to the list.

2 TUTORIAL RAILROAD

TUTORIAL RAILROAD

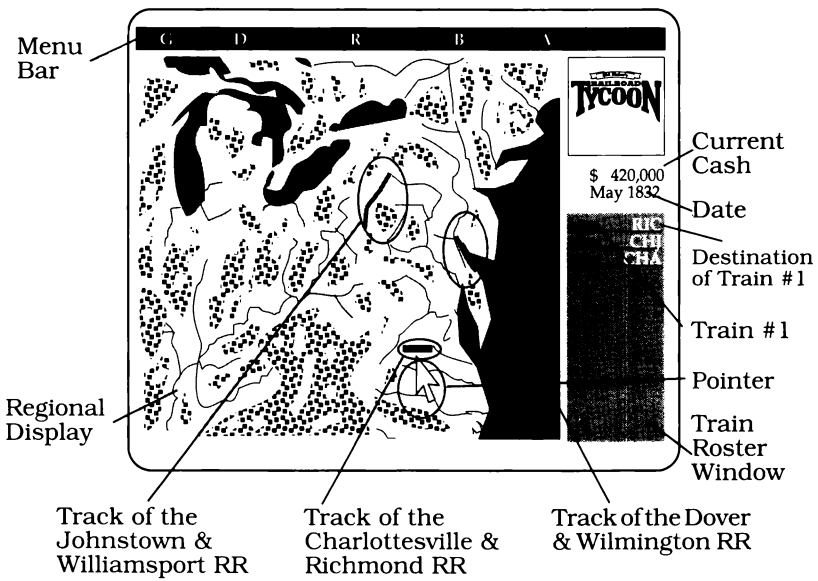
To help new players understand the major concepts of Railroad Tycoon, a working railroad has been started and is described in this section. Follow the instructions for loading this railroad and read through this section with the railroad on your screen. Before attempting to follow the tutorial you need to at least be familiar with the manual section Interface Introduction, page 13.

To load the tutorial railroad, follow the instructions for setting the Pre-Game Options (see page 16) up to the point where you have the option of starting a new railroad, loading a saved railroad, or loading the tutorial. Choose "Load Tutorial". This action skips the remainder of the pre-game options and takes you into the tutorial railroad game. The first step is the drawing of the world map. When the map is complete, press any key to begin the game.

Looking Around

After you press any key from the previous step, the Regional Display opens. Before you do anything else, pull down the Game menu at the top left of the display on the menu bar and choose the option "Game Speed". From the new menu that opens, choose "Frozen". This action freezes time until you change game speed again, and allows you to look around your new railroad before resuming operation.

Regional Display



You are looking at the Regional Display. In the biggest window of the display is the map of the Eastern USA world, and you should be able to recognize the Great Lakes, rivers, and Atlantic coastline. In the bottom right area of the map, just north of one of the rivers, is an angled line that is a different color from the rivers. This is the track of your railroad, the Charlottesville and Richmond. Throughout this tutorial the Charlottesville and Richmond is referred to by its handle, the C&R.

When you play Railroad Tycoon, you spend the majority of your time at this display or one of the three other similar displays. The other three displays are similar in design, except that the maps they show are closer zooms of this world map. For a more detailed description of what you are seeing on these displays and how to use them, refer to the manual section Reading And Using The Displays, page 20.

For now, just pull down the menus listed across the menu bar, one at a time, to familiarize yourself with the options they contain. Note that some of the options have shortcut keys listed after them. You can use these keys to choose the corresponding option without having to use the menus.

After you have looked at the menus, open the next display down, the Area Display. There are several ways to do this, but for now place either the mouse pointer (if you have a mouse) or the cursor (if you don't have a mouse, move the cursor with the *Direction* keys) just

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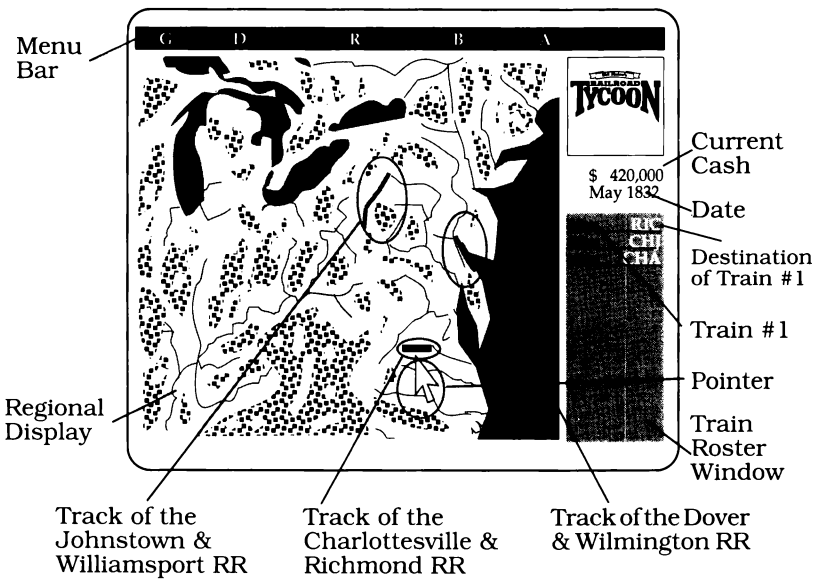

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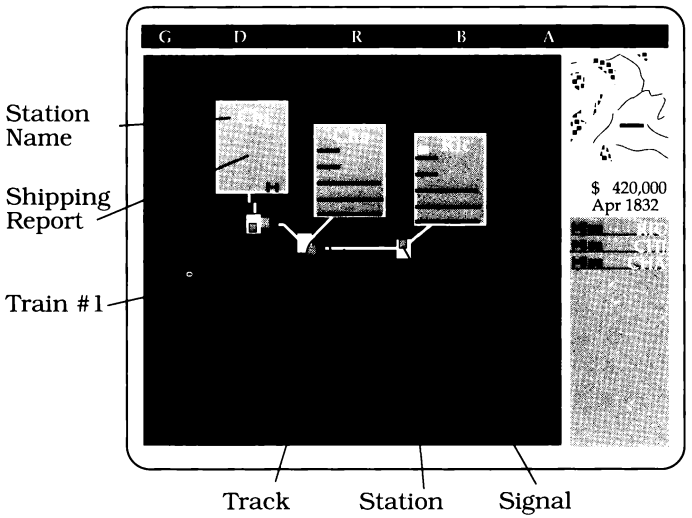
After you have looked at the menus, open the next display down, the Area Display. There are several ways to do this, but for now place either the mouse pointer (if you have a mouse) or the cursor (if you don't have a mouse, move the cursor with the *Direction* keys) just

below the visible track of the C&R. Then open the Display menu with the keyboard and choose "Area Display".

This display is a schematic representation of your railroad, and shows no geography. The parts of your railroad that are visible are the tracks, stations, signals, trains, and Shipping Reports. The Shipping Reports graphically report which cargos are supplied and/or demanded at each of your stations, and are described in more detail in the manual section Shipping Reports, page 58.

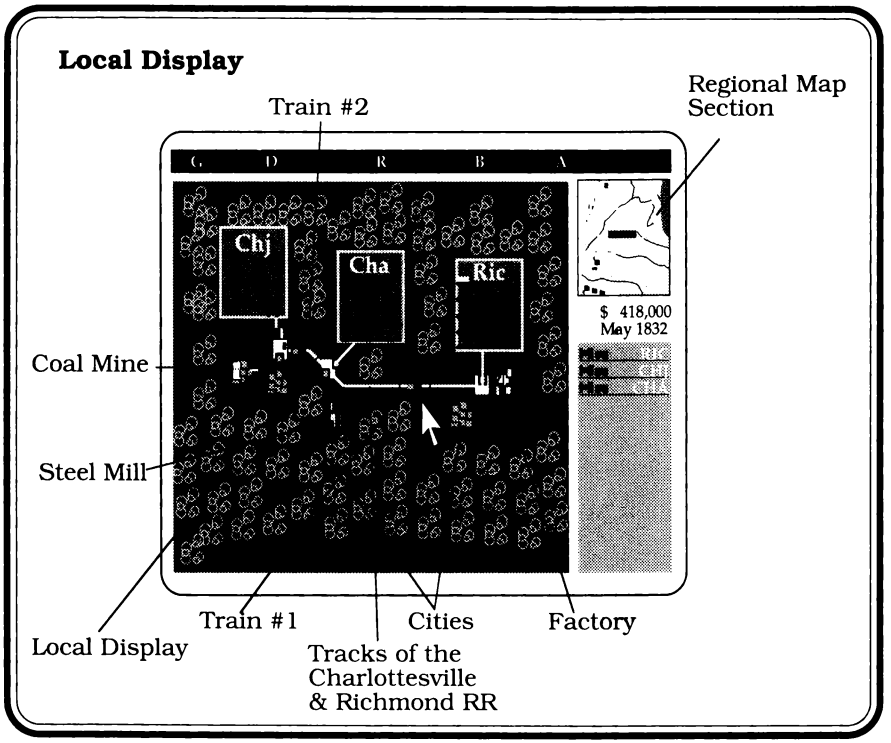
The Area Display



Notice that the display features surrounding the map window have remained unchanged, with one important exception. To the top right of the display where the game's logo previously appeared, there now appears a section of the world map. Within this map section a box appears. The area within the box is the area of the world map now visible within the display window.

This Area Display can be modified to change the information it reports. To see this, open the Display menu and choose "Options". Notice on the menu that appears that Shipping Reports are checked, indicating they are *on*, and that Resource Map is not checked, indicating that it is *off*. Take the time now to switch these features on and off, pressing *Selector 2* after each change to see the effect.

As you play, you may find it helpful to have the Shipping Reports turned off to see more of the surrounding area. The Resource Map shows you at a glance the location of industry and population that



supply and demand goods. For more information, see Resource Map, page 83.

Before going on to the next display, reset the options to Shipping Reports *on* and Resource Map *off*. To zoom in closer to the C&R, center the cursor or mouse pointer just below the Charlottesville Shipping Report (the box marked "Cha"). Then open the Display menu with the keyboard and choose "Local Display".

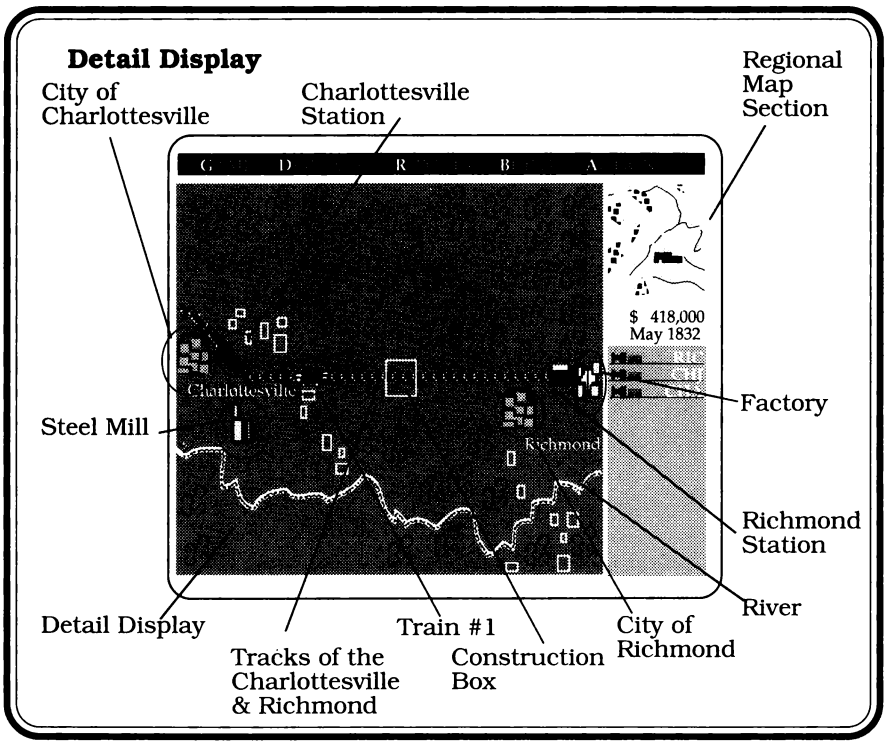
This display is a closer look at your railroad and the nearby geography. Now you can see map icons that represent the different types of terrain, industry, and population centers. These icons are described in detail in the World Economies Chart found on the Player Aid Cards. The parts of your railroad are represented in the same manner as they were on the Area Display.

Note that the display features surrounding the map window have remained unchanged from the Area Display. Also, on this display you may turn off the Shipping Reports or turn on the Resource Map, as was possible on the Area Display.

From this display, for the first time, you can obtain information about some of the map features. Using the mouse, place the pointer on the icon two squares below the Charlottesville station, and press *Selector 1*. Without a mouse, use the *Direction* keys to center the cursor directly on this icon and press the *Information* key. In either case, the icon is revealed as a steel mill.

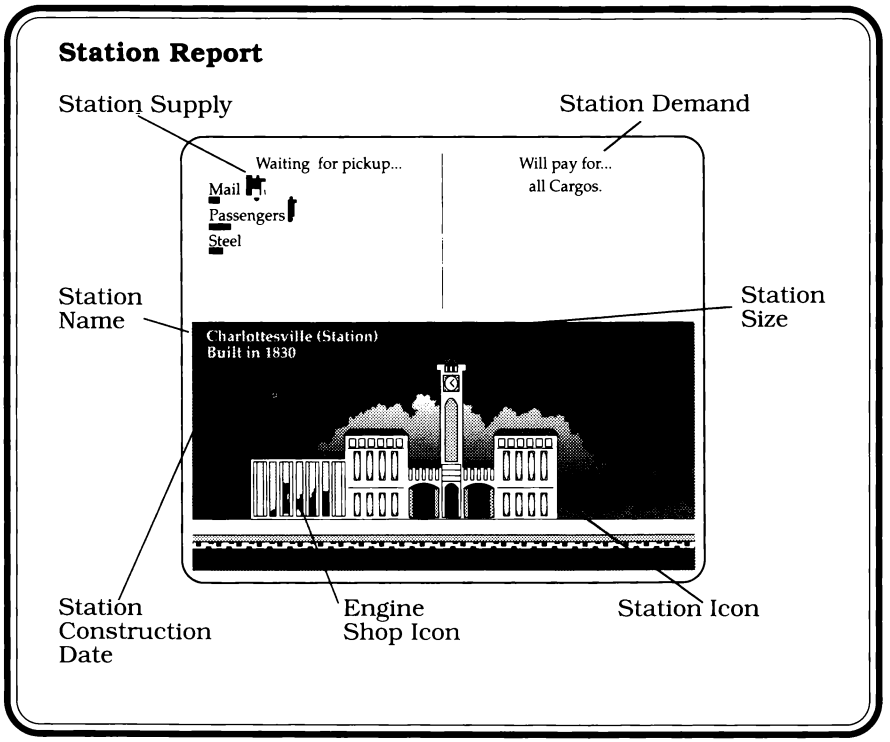
To zoom in as close as possible to the C&R, center the cursor or mouse pointer on the railroad's track, half way between the Charlottesville and Richmond stations. Then open the Display menu with the keyboard and choose "Detail Display".

This display is the closest zoom you can achieve, and the most detailed view of the map and your railroad available. From this view you can see the trains moving in detail, including the smoke puffing from their stacks. Also visible in the greatest detail are the map icons for the geography and industries. The icons now visible are the ones shown in the World Economies Chart on the Player Aid Cards. Also visible for the first time are the names of the cities on the map.



From the Detail Display you can obtain information about the map features present, as you can from the Local Display. However, the Shipping Reports are no longer visible and the Resource Map cannot be turned on.

The Detail Display is the display where all railroad construction is conducted. From this display you lay track and build stations. How to perform these functions is described later in the tutorial. Before beginning construction, you should examine a few reports to get a better idea of how your railroad is operating.



Station Reports

Move the Construction Box onto the Charlottesville Station icon and press the *Information* key or press *Selector 1* if you have a mouse. In either case you open the Station Report for the station at Charlottesville. This report shows you how big the station is, what improvements have been made there (only an engine shop at this time), what cargos are waiting to be picked up (cargos that are supplied there), and what cargos the city will pay for (what cargos are in demand there).

This information helps you plan what trains to run where. You learn, for example, that you can sell anything here that you can carry, and that the city is supplying mail and passengers. If you look at the Station Report for Richmond you see that it also supplies mail and passengers.

This presents you with an opportunity to run mail and/or passenger trains back and forth between the two cities, hauling mail and passengers between them. At each end you can pick up a cargo, take it to the other city for delivery, and then pick up a similar cargo for the return trip.

The information regarding the local cargo supply and demand is also available in the Shipping Reports visible from the Area and Local Displays mentioned earlier. You use the Shipping Reports and the more detailed Station Reports to help plan where you wish trains to run. For a more detailed discussion of how stations work, see Railroad Stations, page 56.

The tutorial railroad is set up to run at the lowest difficulty and reality levels. One of the reality options is the basic economy, where a city icon generates demand for all cargos. To quickly see how a complex economy works, return to the Detail Display from the Station Report, and pull down the Action menu. Choose the option "Reality Levels", and from the menu that opens choose "Complex Economy". This places a check mark next to the option indicating that the complex economy is turned on.

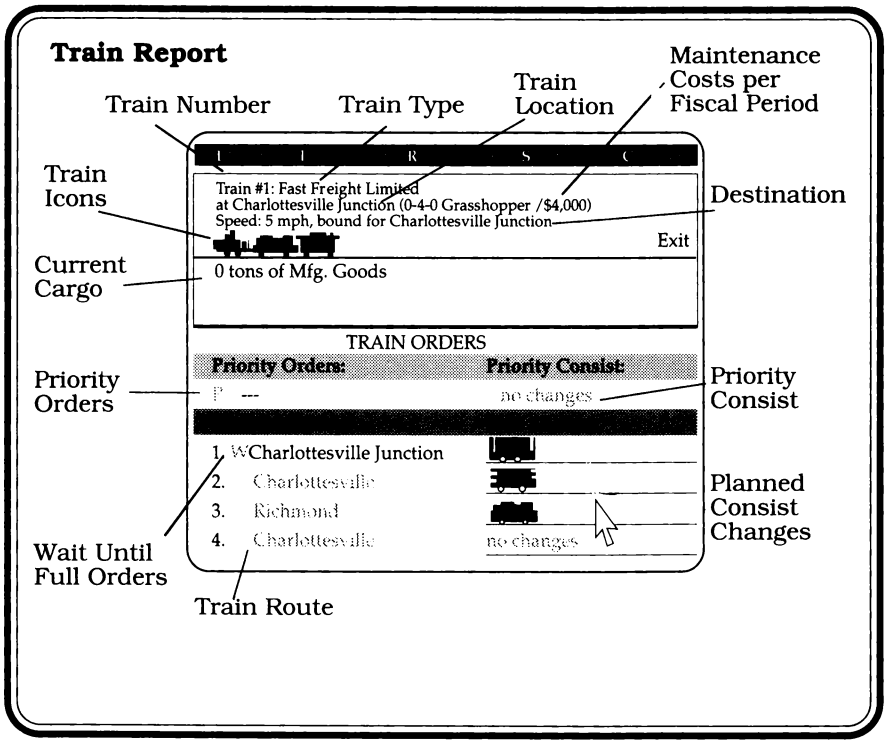
Now return to the Station Report for the Charlottesville station to see the effect of changing to a complex economy. The station will no longer pay for (demand) everything. It will pay only for those cargos that the surrounding industry and population want. The city wants mail, passengers, and goods, the steel mill wants coal, and the paper mill wants wood. These are the only cargos now in demand.

Before continuing with the tutorial, you can turn off the complex economy or leave it on as you wish. Next, it is time to examine one of your trains.

Train Reports

From the Detail Display, turn your attention to the Train Roster at the bottom right of the display. In this area are shown in order the three trains that already exist on your railroad. For each train the roster shows the number and types of cars in the train, the train's destination, and other information as explained in the section Train Roster, page 65. For now you want to use the roster to open the detailed Train Report of Train #2.

To open the report if you don't have a mouse, use the *Tab* key to move the map cursor into the roster, and then use the *Direction* keys to move the cursor down the roster to Train #2. Then press the *Selector* key to open the Train Report. If you have a mouse, place the mouse pointer on the locomotive icon of Train #2 and press *Selector 1*. In either case, this opens the Train Report.



The Train Report that is now visible provides you with detailed information about this particular train, including what it is carrying and where it is headed. For a more complete discussion of what you can see here and what you can do to make changes, see Trains, page 63.

Of particular interest right now is the part of the report titled Scheduled Stops at the bottom left. Listed here are the four stops planned for this train. To the right of the planned stops, under New Consist, some freight cars are visible. The stops and consist changes for this train have been planned to take advantage of opportunities for profit along the C&R.

If you return to the Local Display of the C&R, you can see the reasons for the schedule and consist of Train #2. At Charlottesville Junction there is supply of coal and at Charlottesville there is a steel mill that wants coal. The steel mill takes the coal and converts it into steel, creating a supply of steel. In Richmond there is a factory that wants steel. If it gets steel, it converts the steel into manufactured goods. The city of Charlottesville wants manufactured goods.

So Train #2 has been scheduled to load coal at Charlottesville Junction into a coal car. It then travels to Charlottesville, delivering the coal. The coal becomes steel. Train #2 takes off its coal car and puts on a steel car to carry away the steel. The steel is carried to Richmond and delivered to the factory. The factory converts the steel to manufactured goods, creating a supply of goods. Train #2 takes off its steel

car and puts on a goods car to carry the goods back to Charlottesville. After reaching Charlottesville a second time and delivering the goods, the train switches to a coal car again and starts the route over again.

Note that next to Charlottesville Junction on the list of Scheduled Stops there is a letter "W". This indicates that this train is ordered to wait at this stop until it is fully loaded before leaving. How this order is placed and the advantage it offers is explained in Wait Until Full Orders, page 78.

Note that at this time, Train #2 is listed as a Bulk Freight Local. Open the Train Type menu and select the choice "Limited". This changes Train #2 to a Bulk Freight Limited, and the train now only stops at the stations listed in its schedule, and only in the order listed. In the manual section on Routing Trains, the reasons for making this change are explained in detail.

The manual sections on Routing Trains and Train Consist explain how schedules such as this one for Train #2 are arranged. If you wish, read these sections now. For practice, take Train #3, now hauling coal to Charlottesville, and give it the same schedule and consist of Train #2. Before leaving this report, however, pull down the other menus across the top to see what options are available.

Laying Track

The first real step in getting a new railroad operating is laying track. Although the C&R is already operating, it is going to have to expand to grow and increase revenues. You are going to lay some track to the north of Charlottesville to connect up to the lumber mill on the map in that direction. Wood from the lumber mill can be carried to the paper mill and converted into paper, as noted on the World Economies Chart (see the Player Aid Cards).

To build some new track, return to the Detail Display and place the Construction Box on the track section directly below the paper mill that is to the east of the Charlottesville station. Now press the *Track Construction* key for laying track in a northeast direction. You see a new track section appear, branching off from the mainline to Richmond. Lay one more section in a northeast direction.

Because the terrain directly ahead is hills, it might pay to survey the local area to see what the best route is. Press the *Center* key to center the map on the Construction Box, and then open the Action

menu and choose "Survey". The elevations of all the visible map squares are revealed and this makes it clear that laying straight ahead would mean a steep rise in the relative elevation. However, if you build north for a while and then curve around the hills, the elevation changes remain reasonable. You can leave the survey on if you like, or remove it by pressing the *Center* key again.

Lay four more track sections straight north, and then one more northeast. That brings your track adjacent to the lumber mill. Note that with the laying of each track section, your cash is reduced. Cash is being spent for the track and the land, or right-of-way, that the track takes up. You now have the track completed for the connection to the lumber mill, and it's time to put a station there to load the wood.

Building A Station

To build a station for the lumber mill, place the Construction Box on the track section that ends next to the mill. Pull down the Build menu and choose "Build Station". A new menu appears from which you choose the type of facility to build. Also, the economic radius of the types of stations available appears centered around the Construction Box.

The economic radius is explained in further detail in the manual section How to Build a Station, page 58. Basically it represents how far people and industry are willing to travel to each station type to pick up deliveries or drop off cargos to be shipped. The better the station, the farther they will come. Since your station is going right next to the lumber mill and there are no other likely customers nearby, you need only build the smallest station, a Depot with a radius of one square in every direction.

Choose "Depot" from the list of options, and a station report for the new station at Charlottesville Crossing appears. This report shows that the station can be expected to supply 2 cars per year with a normal economy, and that no cargos are in demand here. Now that the track and a station have been built to a supply of wood, you need to put on a train to carry the wood to the paper mill.

Building A Train

To build a new train to carry the wood, pull down the Build menu and choose "New Train". A new window appears offering you the choice of locomotives to put on the train. However, at this time, only one locomotive is available, the 0-4-0 Grasshopper.

If you don't have a mouse, a menu appears from which you can only choose the Grasshopper locomotive. If you have a mouse, no menu appears, but you make your selection by placing the mouse pointer on the icon of the locomotive on the left side of the window and pressing *Selector 1*.

In either case, you are taken to the Charlottesville Station where the new locomotive is built. The engine appears here because the only engine shop on your railroad is at Charlottesville. (For more information about the engine shop and other facilities that can be built at your station, see Station Improvements, page 61.)

The new locomotive drives out of the engine shop and stops to the left of the station platform. At this point you add the cars that you want on the train. You can put as many as 8 cars on any train, but this tiny locomotive is not capable of pulling that many. As time passes and better engines are developed, you can build much bigger trains, but for now just put on one wood hopper car. When the hopper is on, choose "No Thanks" to complete the train. You now go to the Train Report for your new train, Train #4.

Your train is ready to go except that its schedule sends it back and forth from Charlottesville to Richmond. You want this train to go to Charlottesville Crossing instead, to pick up wood. You need to make this schedule change before allowing the train to start out.

To change the schedule when you don't have a mouse, use the *Direction* keys to move the highlight box that is visible to the row marked #2 under Scheduled Stops. Now open the Schedule menu on the menu bar at the top of the report and choose "Change Station". This opens the Route Map. Use the *Direction* keys to cycle the cursor around the stations of your railroad until the cursor highlights Charlottesville Crossing. Press *Selector 1* to choose Charlottesville Crossing and return to the Train Report.

To change the schedule when using a mouse, place the mouse pointer on the city name "Richmond" and press *Selector 1*. This opens the Route Map. Move the mouse pointer to the small box beside Charlottesville Crossing and press *Selector 1*. Press *Selector 2* to return to the Train Report.

In either case, Charlottesville Crossing is now stop #2 on the list of scheduled stops for Train #4. This train is now scheduled to run back and forth carrying wood to the paper mill at Charlottesville. You can now leave the Train Report.

Restarting The Railroad

You have now examined the major game functions that you must understand to play Railroad Tycoon. Pull down the Game menu again and choose "Game Speed". Set the speed to "Slow" and let your railroad begin operating. Take the time now to examine some of the reports found in the Reports menu. They are explained in detail in the manual chapter, Railroad Business, page 94. Zoom in and out among the displays, and turn on the Resource Map for a while to look for likely areas to expand the C&R.

It may be useful to save the C&R at this point, and then experiment with new routes, trains, and the reality options. To save the game at this point, pull down the Game menu and choose "Save Game." Your first experiments with Dispatcher Operations may result in some collisions, unless you have studied the manual section on Operating Trains, page 88, and have broken up your railroad into signal blocks. If things go wrong, simply reload the C&R from where you last saved it and try again.

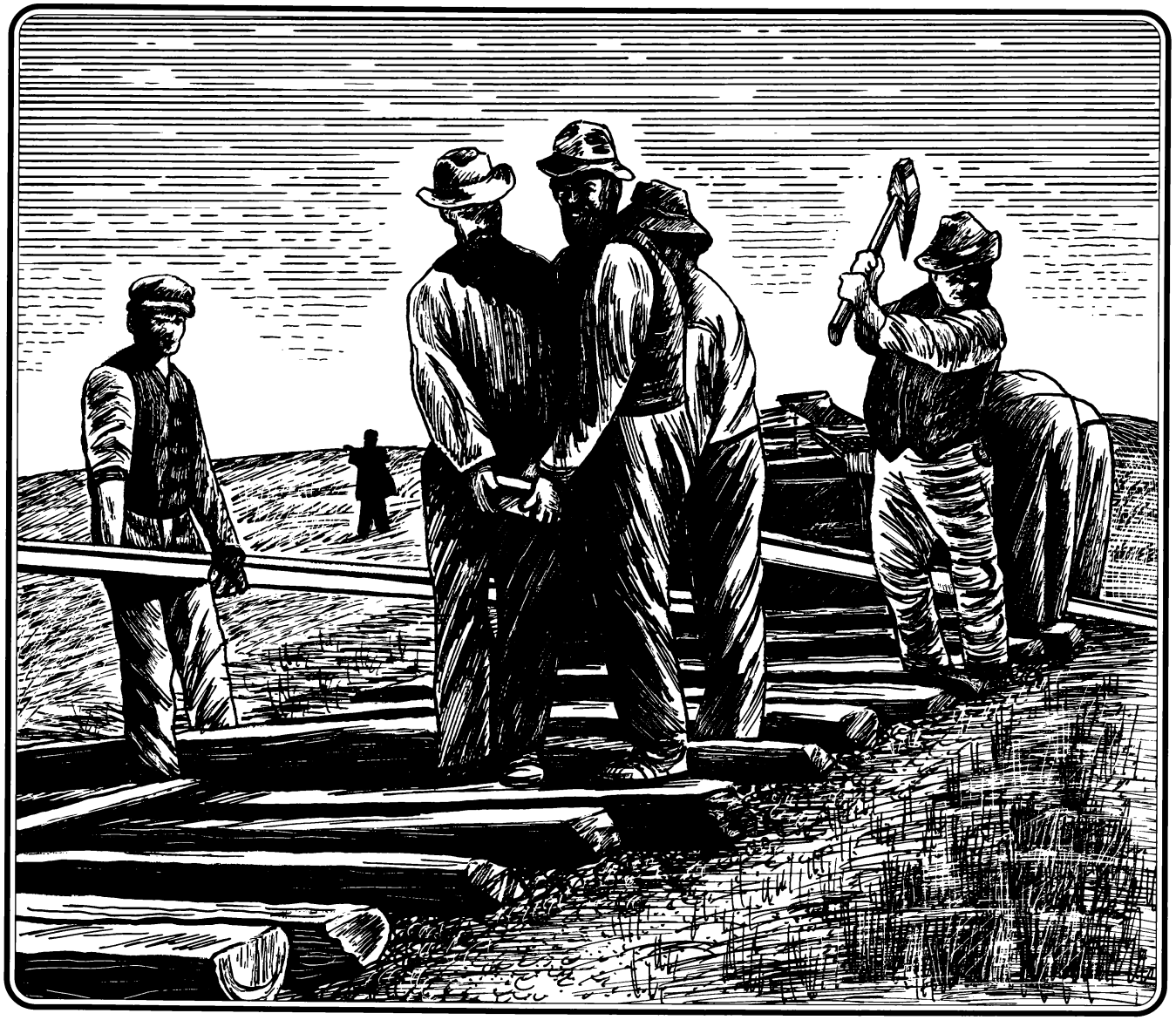
Reality Experiments

If you decide to experiment with Dispatcher Operation, consider placing a signal tower halfway between Charlottesville and Richmond, and two more just after the switch on the way to Charlottesville Crossing. Place one on the mainline east of the switch and one on the branch line on the north side of the switch. Experimentation and reading the section on Operating Trains, page 88, should make it clear how these signals can speed the movement of your trains.

The track between the new signals at the Charlottesville Crossing switch and Charlottesville can be double tracked to allow two trains at a time to move through this block.

You may also consider changing over to a complex economy. The C&R as set up for you can operate perfectly well with a complex economy. Further profitable expansion, however, will require that you understand how stations work, and the relationship between industry and cargos.

When you have finished experimenting, it is time to restart the game, select your new railroad world, and build your own railroad from the beginning.



3 RAILROAD ENGINEERING

LAYING TRACK

Where a railroad places its track can make a significant difference in its operations and profits. If track is laid up a hill, every train using the route must slow down or increase power to make the climb. If the track is sharply curved, trains must again slow down to prevent derailment. Poor track planning increases costs and reduces earnings.

The most desirable track is straight and level, allowing trains to maximize speed in both directions. The more curves and grades, the slower trains can move and thus, the slower deliveries are made. Since most revenue is tied to speedy delivery, slow trains may be the difference between profits and losses.

Once a railroad decides to lay track between two points, the construction process takes several steps. The first is to send engineers into the country to survey the geography. The surveyors select a route that minimizes grades, curves, and right-of-way expense. Railroads must buy the land, or right-of-way, over which their tracks are to be laid. The route selected should pass over undeveloped and less expensive real estate where possible, rather than expensive residential or industrial areas.

Once the route is selected and the right-of-way acquired, track laying begins with the leveling of the roadbed to as nearly level a grade as possible. This may require earth fills in depressions, cuts through ridges, and bridges and tunnels for more serious obstacles. Once the road bed is prepared, on goes the gravel ballast, the wooden crossties, and finally, the steel rails.

In Railroad Tycoon you may also survey the areas through which you wish to lay track. By conducting your survey you can plan how best to run your tracks so as to minimize grades, curves, tunnels and

bridges. Building tunnels and bridges greatly increases the cost of your track, but may be a better alternative to long detours or steep grades.

Your trains will move more slowly up steep grades and through tight curves, so good planning before the trains start running will increase your average train speed and profits over the life of your road. As construction engineer of your railroad you must carefully balance the cost of alternative routes versus their effects on your train operations.

How To Lay Track

Track is constructed on the Detail Display only. It is built in sections, one section at a time. A track section connects the center of one map square to the center of an adjacent square.

To lay a section of track, center the Construction Box on the map in the square from which you wish the track piece to be constructed.

Press the correct *Track Construction* key to build a section of track in the direction you desire. Watch the new track piece appear and note that the cost of the right-of-way and track construction are subtracted from your cash.

Once your first section of track is laid, you can continue putting down more track in any of six directions: straight ahead or back, a 45 degree angle to the left or right, or a 90 degree angle to the left or right. However, once track building begins, you may only build new sections off of existing track. You cannot thereafter start a new section independent of existing track.

All track built into a new square is single track. (See Double Track below.)

You may build switches by having track split off an existing track piece at a 45 degree angle (not a 90 degree angle), but either the switch or original track must be a straight section. You cannot build a "Y" track junction.

You may not lay track across another section of your track or a section of another railroad's track.

Surveys And Grades

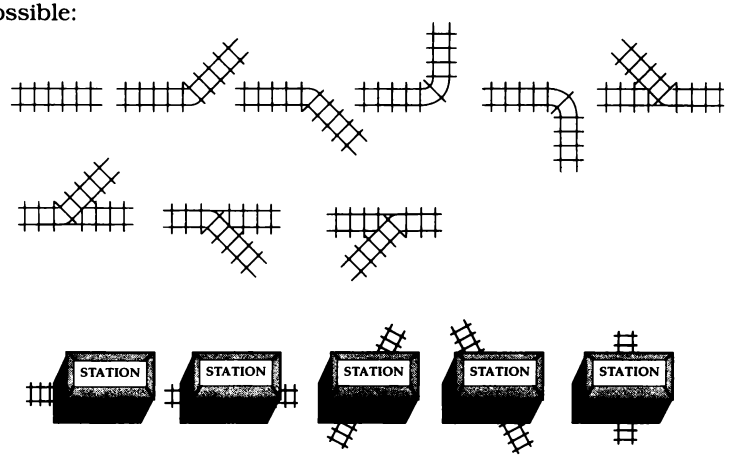
As you lay track you may receive a message reporting that the section you wish to lay has a grade of a certain size, 1.5% or higher. The higher the percentage, the steeper the grade and the slower trains can move here. You are given the choice of proceeding or not with construction. Before laying the track consider conducting a survey of the area to look for an easier route.

You can survey an area by centering it in the Detail Display and choosing "Survey" from the Action menu. In each square of the map a number appears. These numbers represent the relative elevations of the squares. Grade percentages result from a complicated calculation of the differences between the elevations of two adjacent squares.

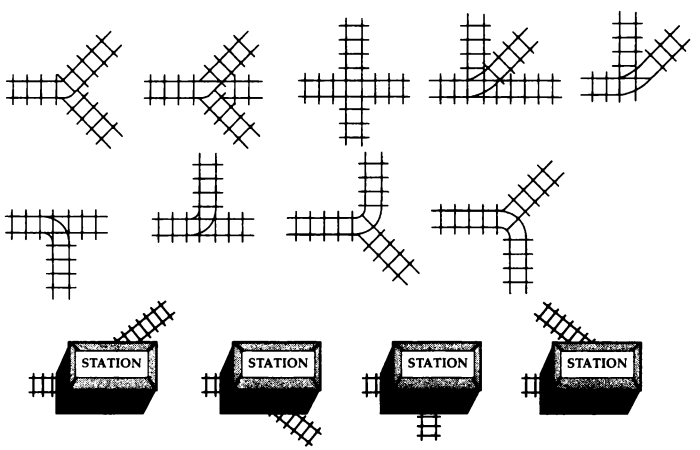
Trains are slowed down by even the tiniest grade, and are only unaffected when moving downhill or on a level. Grades of some sort are all but impossible to avoid, and in many cases you have no good alternative but to accept grades of 3% or even higher.

Track Examples

Possible:



Impossible:



River Bridges

Bridging the gaps over rivers and other geographic features was a major engineering challenge for railroads. In the early days the material of choice was stone, but its expense often forced the compromise of wood. As technology and engineering science progressed, engineers turned to steel as the best structural material for their bridges. It was relatively cheap but still capable of supporting the growing weight of trains.

You may lay track across rivers by building bridges. To build a bridge, proceed as if you were laying a normal straight track section. Bridges cannot be built on curves. A menu appears showing you the cost of each bridge type now available. You have the option building any one of the bridge types, or of not building the bridge at all.

River bridges may only be built in a straight line over one river square. The bridge is built from the starting square to the first land square on the river's other side. You may not build a bridge that crosses more than one river square.

Floods may wash out your bridges. Trains on bridges that wash out or that cannot be stopped or rerouted before going off of a washed out bridge are destroyed (see Train Wrecks, page 80). A washed out bridge is rebuilt after the passage of sufficient time. You cannot speed the rebuilding process, or build a bridge of a new type at this location while the washout remains.

You have a choice of up to three types of bridge to build. A wooden trestle costs $50,000 and is very susceptible to washouts. A steel girder bridge costs $200,000 and is much harder to wash out, but is not available until the technology for it is achieved. A stone masonry bridge costs $400,000 and is almost impervious to floods. Only steel and stone bridges may be double tracked, wooden trestles may not.

Ferryboats

It is possible for your trains to cross tidal estuaries, the ocean, or large lakes with the help of ferryboats. To build a ferryboat, proceed as if you were laying track over the ocean or lake. In effect you build a ferry route. This route may include curves, but it may not be double tracked.

Ocean ferries are built one square at a time. If the water to be crossed is several squares wide, you must continue building ferry

sections to the other side of the water.

Trains move over ferries as if they were normal track sections, except that train speed is very slow.

Ferries can not be sunk or otherwise damaged.

Tunnels

When a hill or mountain along a planned route was impossible to build around or slice through with a cut, the last resort was a tunnel. Despite their cost, tunnels were normally bargains that eliminated the need for long, tortuous switchbacks with steep grades or long detours.

In Railroad Tycoon you may have situations where your tracks cannot cross a mountainous area without building very steep grades. In these situations the increase in train speeds may justify the cost of a tunnel.

If you attempt to build a straight track section of sufficiently steep grade, your engineers inform you that building a tunnel may be an option here. To build it, choose the "Build Tunnel" option from the choices presented. The engineers then calculate how long the tunnel needs to be to come out at the same elevation it starts at. A second menu appears reporting the required length of the tunnel and its cost. To build the tunnel, again choose "Build Tunnel". To not build the tunnel, choose "Never Mind".

If you build the tunnel, it appears on the map and you can continue building track from its end. The track inside the tunnel is straight and level.

Tunnels are constructed at the elevation of the square from which they are built and therefore have no grade.

Tunnels may not be double tracked.

Double Track

The value of having two tracks between stops, one for traffic in each direction, was recognized by railroads early on. With a flexible system of switching between the tracks and monitoring the relative position of trains, double tracking made train movement more efficient. Doubling track, even at a later date, was much less expensive than the cost of a second single track because the right-of-way was already owned and much of the preparation was already accomplished.

In Railroad Tycoon all of the track you lay is single track, but you may go back over existing sections and double track them. This

immediately doubles the number of trains that can safely move over any section (see Operating Trains, page 88. However, doubling track is expensive and normally necessary on only your busiest sections. Monitor your train operations and double track those parts of your railroad where too often trains are kept idle waiting for tracks to clear.

To double a track section center the Detail Display over the area to be improved. Place the Construction Box on the section to be doubled and press the *Double Track* key. Note the change of the section to the map symbol for double track. Track is doubled one section at a time.

The following features may not be double tracked: 90 degree curves, tunnels, and wooden trestles.

All stations, including signal towers, are automatically double tracked.

Track And Bridge Demolition

Railroads occasionally found it necessary to rebuild or remove track and other structures. The B&O for example, rebuilt itsmain line from Baltimore to Harpers Ferry several times to eliminate difficult curves and grades. As railroads have concentrated their business into long, mainline hauling, many branch lines have been abandoned and torn up. Many industries have gone over to truck transport, or entirely disappeared, eliminating the need for rail transport to communities.

In Railroad Tycoon you may find circumstances where a station no longer needs to be served because the local industry has gone out of business, or where a bridge that can be double tracked is a good investment, etc. In these cases it may be financially beneficial for your railroad to remove or realign your tracks. Note that track not being used stills costs you money for maintenance.

To demolish a track section or bridge from your railroad, go to the Detail Display and place the Construction Box at the end of the section or bridge to be removed. Pull down the Build menu and choose the "Remove Track" option. Note that the Construction Box changes color, signifying that your work crews are now prepared for demolition.

Press the *Track Construction* key for the direction in which you wish to tear up track and the section is removed. When track is removed, you receive cash for the value of the right-of-way that is sold.

When you have completed all desired demolitions, pull down the Build menu again and choose the "Build Track" option. This returns the Construction Box to its normal color signifying that track building is again possible.

Railroad Stations

The first regularly operating railroad station in the United States is thought to have been built by the Baltimore & Ohio Railroad in the Mount Clare area of its home city. This station was used for many years until the passenger and freight traffic passing through it grew too large. Most of its functions were moved to a larger station in the Camden area that was better equipped to handle the traffic flow into and out of the expanding city.

The purpose of a railroad station, like those on the B&O, is to provide a place for people and goods to transfer to and from trains. A small platform by the trackside where farmers drop off their milk cans, the special sidings adjacent to a coal mine, or the New York Central's Grand Central Station in Manhattan are all examples of stations or facilities functioning as stations.

In order to work efficiently, a railroad sets up a network of appropriately sized and equipped stations to provide reasonable service to its customers. Grand Central Station would be wasted in a small rural town, while a small commuter station would not begin to handle the needs of New Yorkers.

In Railroad Tycoon, you have a choice of three different sized stations to build. The larger the station you choose for a location, the larger the surrounding area it serves. However, larger stations cost more. Your challenge is to accurately assess the needs of the local community and provide a station that provides the most service for a reasonable investment. A station that is too large is a waste of money, and a station that is too small reduces the local supply and demand for cargos, lowering potential revenue.

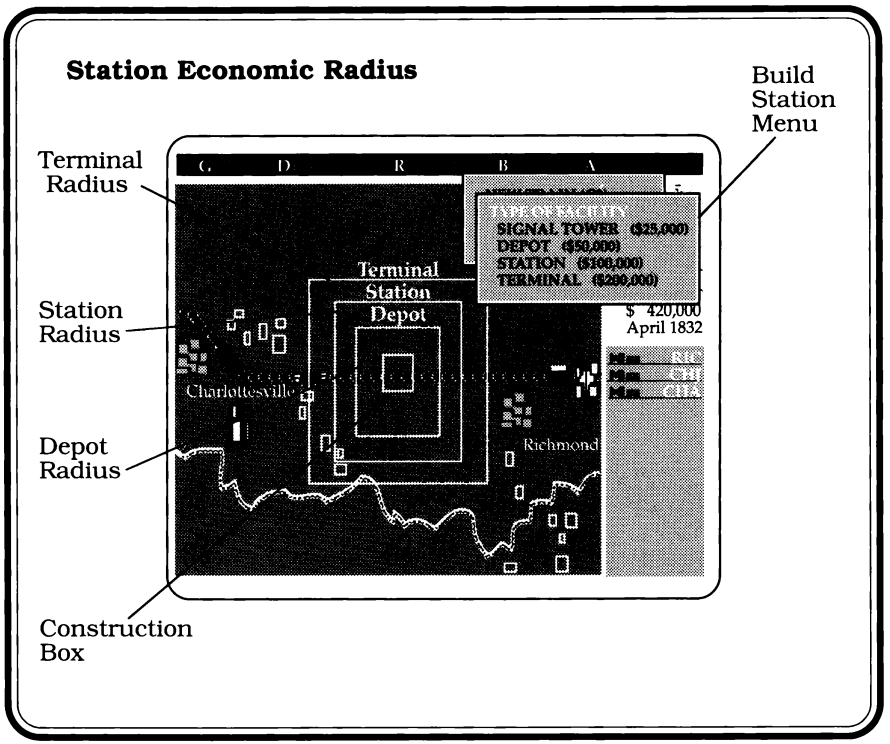
Description

In Railroad Tycoon stations are the only places that trains can stop to pick up and deliver cargos. Building track into industrial sites or cities has no effect on creating supply and demand for cargos. The transfer facilities that automatically come with a station must be present for pickups and deliveries to take place.

There are three types of station: Depots ($50,000), Stations ($100,000), and Terminals ($200,000). They are differentiated by their cost, economic radius, and map icon.

The economic radius is a range in squares out from the station in all directions. The better the station, the farther people and industry

can be expected to travel to do business with your railroad. All industrial and population sites within the radius of a station send (supply) and receive (demand) business through the station. By adding together the supply and demand for cargos from the industry and population within range, the supply and demand for the station is determined. For example, assume each coal mine creates an average supply of two carloads of coal per year. A station with three coal mines within its economic radius then generates a supply of about six carloads of coal per year.



A Depot has a radius of one square in all directions, a Station has a radius of two, and a Terminal has a radius of three. The square the station occupies also contributes. During the station construction process you are graphically shown the radius of each station type before you actually spend money to build. Examine this graphic to determine which station incorporates the area that you desire.

The section of track that any station occupies is automatically double tracked.

Each station comes automatically with a Signal Tower attached (see How Signals Work, page 89). Additional facilities can be built at any station location (see Station Improvements, page 61). An engine shop is automatically built at the first station that you build.

How To Build A Station

Railroad stations are built on the Detail Display. Place the Construction Box on the track section square where you want the station. Pull down the Build menu and choose "Build Station". A second menu appears offering four choices: "Signal Tower ($25,000)", "Depot ($50,000)", "Station ($100,000)", or "Terminal ($200,000)". For now, ignore the Signal Tower (see Signal Towers, page 90). Choose the station type you wish to build and press *Selector 1*. The icon for the station type you chose appears under the Construction Box.

Immediately thereafter a graphic appears describing the station you just built. The station is named, and its type is shown with the date of construction. In a window is displayed the average yearly supply of specific cargos this station can be expected to generate, if any, plus a list of cargos that are demanded here.

Stations may only be built on straight track sections, not curves. The straight section may end in the square chosen, thereby placing a station at the end of the line.

Stations may not be built if their economic radius overlaps the radius of a nearby station in any square.

To replace a station with a larger or smaller one, repeat the procedure for building a station and place the new station on top of the old one. For example, if you have a Depot that you wish to replace with a Terminal, center the Construction Box on the Depot and then follow the procedure for building a Terminal. The Depot is replaced by the Terminal.

Shipping Reports

An operating railroad must be flexible in its ability to reroute trains, add or delete trains, and otherwise adjust its service in response to changes in the supply and demand of cargos along its system. The opening of new coal fields, the burning down of a factory, or the growth of a city's population are the kinds of factors that are constantly affecting railroads. A nimble management quickly adjusts to increased supply of steel here and decreased demand for livestock there by switching livestock trains to steel. Otherwise, trains that could earn revenue in one area run mostly empty in another, while the maintenance costs pile up.

In Railroad Tycoon you monitor the supply and demand of cargos at your stations by checking their supply and demand reports. When you see supplies of cargos to be shipped piling up on one station's report, you need to look at your other Station Reports to find places to deliver those cargos.

Supply and demand information for your stations is found in two places, Shipping Reports, and their cousins, Station Reports discussed on page 60. These two reports are available at all times for each station on your railroad.

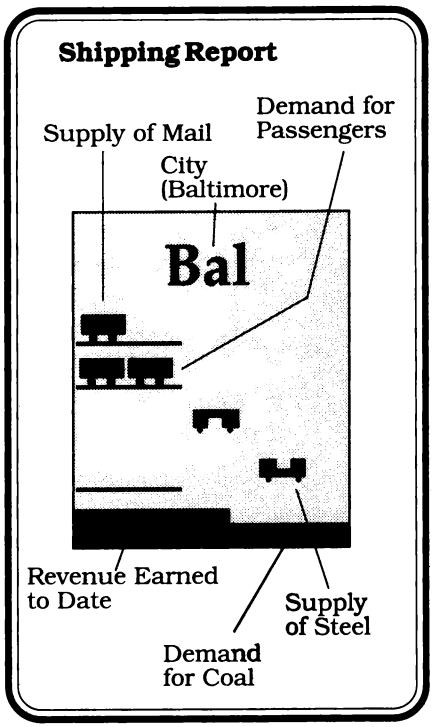
To see a station's Shipping Report, go to either an Area or Local Display of the part of your railroad containing the station. The Shipping Report is the window attached to the station icon by a line, and is also identified by a three letter abbreviation of the station's name.

In addition to the name of the station, you can read the following information on the Shipping Report: what cargos are demanded here; what cargos are now available here to be shipped, and roughly how many cars of each; whether freight rates for deliveries here are halved, normal, or doubled; whether a priority shipment is available or demanded here (see Priority Shipments, page 85; and a relative measure of revenue earned for deliveries to this station.

A short line in a column of the report indicates that that cargo is demanded at this station. For example, a line in the first column of the second row indicates you can earn revenue for bringing passengers here.

One or more train car icons in a column indicates the number of carloads of the corresponding cargo now available here to be picked up by a train. No more than four car icons appear in a column, although more carloads than that may be available.

The border around the window indicates freight rates. There is a border color for normal rates, for half rates (only during rate wars, see page 109), and double rates (see the Technical Supplement for the correct colors). Double rates exist for a new station from its opening until the end of the current fiscal period, and for one fiscal period after a successful rate war.

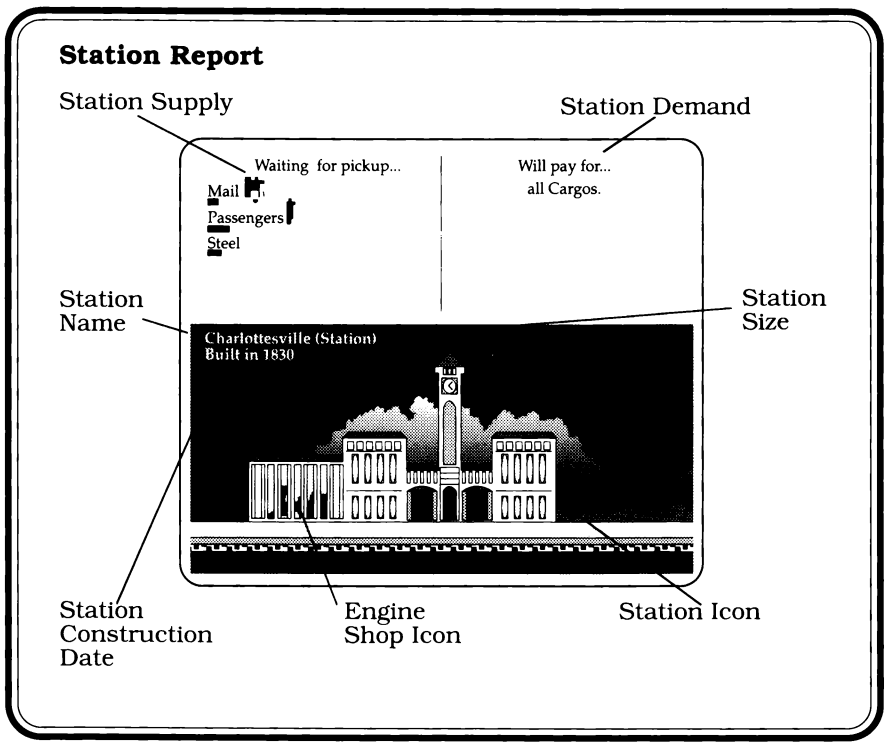


To indicate where you are making money, the bottom of the Shipping Report window fills in as revenue is earned for delivering cargos to this station. The fill is emptied at the end of the fiscal period.

The freight class cargos for England and Europe are slightly different from those in the USA, as shown in the Shipping Reports on the Player Aid Cards.

Station Reports

A Station Report provides supply and demand data in a different format from the Shipping Report, plus other information as well. Where the Shipping Report can show a maximum of four carloads of a cargo waiting, the Station Report can show a more accurate account using both car icons and actual numbers.



You can call up a Station Report from the Area or Local Displays in two ways. If you are using the mouse, place the pointer on the Shipping Report and press *Selector 1*. If you are playing without the mouse, use the *Direction* keys to center the Construction Box over the station and press the *Information* key.

From the Detail Display, the Construction Box must be centered on the station for the *Information* key or *Selector 1* to call up the Station Report. However, when using the mouse, if you position the pointer on the station and press *Selector 1*, the Construction Box moves to the station square and then either *Selector 1* or the *Information* key open the Station Report.

Station Improvements

In addition to stations and track, railroads developed a need for additional facilities and structures to improve the efficiency of the road or bring in additional revenue. Railroads built shops at strategic spots along their lines for building and maintaining locomotives and rolling stock. Switching yards were required at major junctions and stops where trains could be quickly broken up and reassembled. Railroads that skimped on these facilities paid high maintenance costs or provided unsatisfactory service.

Railroads also found that they could earn money on additional services beyond transportation. They built railway hotels near their stations, and included restaurants in the stations themselves, such as those on the Atchison, Topeka, and Santa Fe run by the Harvey Girls (the best food in the west!).

On your railroad you may build similar facilities to keep maintenance costs under control, store certain cargos to reduce wastage, and earn revenue. However, facilities are not cheap and you must carefully measure their benefit versus cost. Decide what facilities to add where based on the operating needs of your railroad and the traffic passing through individual stations.

At each station (but not signal towers) you may build any of the following improvements:

Engine Shop	$100,000
Switching Yard	$50,000
Maintenance Shop	$25,000
Food Storage	$25,000
Livestock Pens	$25,000
Goods Storage	$25,000
Post Office	$100,000
Restaurant	$25,000
Hotel	$100,000

New trains may only be started at stations containing an engine shop. When you build a new train you are given the choice of which of your engine shops to place the locomotive. If you have only shop, the new train must start there. Having more than one engine shop makes placing trains on the far reaches of your railroad easier. Engine shops also act as maintenance shops. A switching yard reduces the time

required to change the cars in a train by 75% (see Train Consist, page 75). Place switching yards at stations where trains regularly change their consists. The more trains you have changing at switching yards, the greater the distance your trains can travel in a year.

A maintenance shop reduces the maintenance cost of trains that pass through its station in a fiscal period by 75%. Trains that do not receive regular maintenance may pay very large maintenance bills and erode your railroad's profits. In your role as master of the road, your staff informs you which trains are not receiving regular maintenance each year.

All supplies of cargos that are not picked up eventually waste away. In effect they are picked up by some alternative transport. Storage facilities prevent this wastage of cargos at the station where they are built. Post offices store mail. Food storage warehouses store food. Livestock pens store livestock. Goods warehouses store manufactured goods. England and Europe have storage for cargos unique to their worlds.

Restaurants and hotels earn additional revenue from passengers delivered to their stations, with hotels earning two times the revenue of a restaurant. Rail travelers need to be fed and often require overnight lodging when arriving or departing. Railroads that provide these services fill the needs of their customers and earn extra revenue.

You build station improvements from the Detail Display. Center the Construction Box over the station to be improved, pull down the Build menu, and choose "Improve Station" from the options. From the list of improvements that appears, choose the one you wish to place.

At the station you see the improvement being built. Press *Selector 1* to return to the game.

You may build each facility only once at a station. A facility that already exists at the station is shown in parentheses with no cost when you pull down the menu and cannot be purchased again.

You receive an engine shop with the first station you build. Its cost is automatically subtracted from your cash.

TRAINS

The function of a railroad is to transport people and freight from one place to another, and this is physically accomplished by trains. A train consists of two parts, an engine providing the power for motion and the carrying vehicles pulled by the engine. In the United States the engines and carrying vehicles are generally known as locomotives and cars.

Since the earliest days of railroading there has been a continual evolution in the technology of both locomotives and cars. Safety, efficiency, and reliability have increased.

For locomotives the evolutionary trend has generally been toward higher speed and greater pulling power. In addition, locomotive designs were adapted to the role they were to perform and to the geography the road ran through. For example, trains operating in mountain or plains areas required different gear ratios. Locomotives designed for express passenger trains had relatively less pulling power but generated higher speed. Where speed was of less importance, such as for bulk cargos like coal, gearing and wheel size emphasized pulling power.

In addition, locomotives have evolved from wood burning steam engines to coal and oil burning steam engines, diesel-electrics, diesel-hydraulics, and electrics.

Cars have gotten larger, but mainly more specialized. The earliest cars were horse-pulled wagons fitted for use on rails. These evolved into specific cars for passengers, livestock, coal, liquids, etc.

The job of the master of the road is to provide suitable locomotives and cars for the service the railroad is providing. This mix of equipment and rolling stock must be maintained, upgraded when outmoded, and adjusted for changing service needs.

In Railroad Tycoon you must continuously monitor the equipment and rolling stock needs of your railroad so that the correct cars and trains are in operation. As time passes new locomotive designs become available for your railroad and correctly matching locomotives to tasks improves your road's efficiency. For example, a fast Ten Wheeler locomotive pulls a two or three car passenger train much faster than a powerful Consolidation locomotive, but the Consolidation pulls a 6 car coal train much faster than the Ten Wheeler would.

In addition, you must be sure that the proper cars are available when trains arrive in a station to load cargos. A train of passenger cars

is not going to take on a load of oil. You arrange for the correct cars to be in the right place by setting the routes of your trains and/or changing the cars in an arriving train to provide the desired service. Incorrect routing or cars means cargos are not picked up and revenue is lost while the maintenance cost meter is running.

Building Trains

You place a new train on your railroad by first building a new locomotive and then buying cars to couple to it. In order to build a new locomotive, however, you must have previously built at least one railroad station. This is necessary because all new trains appear with their locomotive at an engine shop, and your first engine shop appears automatically with the building of your first station.

When at least one engine shop exists on your road, you may build new trains from any Display. To build a new train, pull down the Build menu and choose "New Train". This opens the New Train window that shows a picture of the locomotive types available, their characteristics, and their cost. If you are using the mouse, place the pointer on the icon of the locomotive you wish to build and press *Selector 1*. If you don't have a mouse, an Engine menu appears. From this menu choose the train you wish to build, or the "None" option if you decide to build no locomotive.

If you build a locomotive, another menu appears listing your choices of engine shops where the locomotive may be constructed. If you have only one engine shop this menu doesn't appear. When necessary, choose the location for your new train by selecting the desired option.

Having chosen the location for the new train, you go to the station where it was built and watch the new locomotive driving out of the engine shop. The engine stops on the left side of the platform ready for you to add cars. Choose new cars one by one from the Car menu now present. When the train is finished to your satisfaction, choose the "No Thanks" option. This opens the Train Report discussed below.

A train may include up to 8 cars, of any combination of types. You may build a train containing no cars. (They can be added later on the Train Report.)

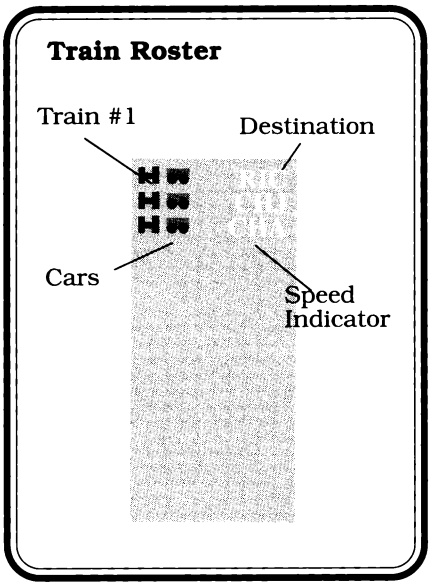
Train Roster

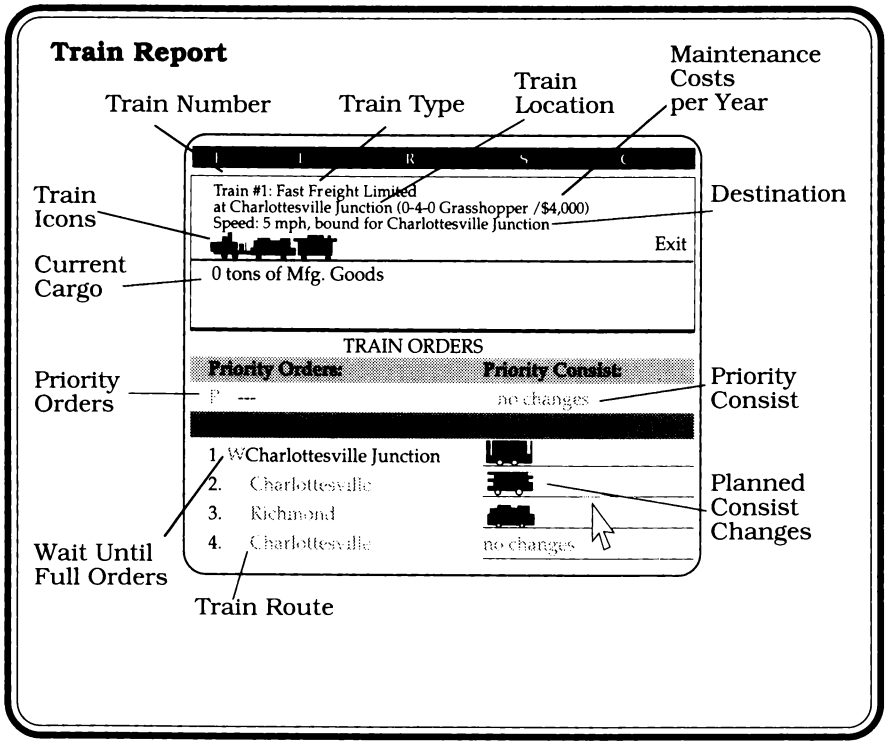
The Train Roster is a graphic display of the trains currently running on your railroad and is placed at the lower right of the display windows. When a new train is purchased, it is added to the roster. The oldest train on your railroad is at the top of the roster and the newer trains are added in order below it. The bottom train on the roster is the most recent train added.

Each train occupies one line on the roster, with a locomotive symbol at the left of the line and up to eight car symbols to its right. The car symbols are the same ones that appear in Shipping Reports. From their shape and color you can tell at a glance what type of car each represents. In addition, the color of the cars changes slightly depending on whether the car is at least 50% full or not.

At the far right of the line is a three letter abbreviation for the name of the city that is the train's next destination. In the above example, the first train is headed for RIC, the abbreviation for Richmond.

A colored line that appears below a train's destination indicates the train's relative speed.





Train Reports

As each new train is built on your railroad, a Train Report is created for it. Thereafter, this report is always available for consulting.

A Train Report provides in one place the important information concerning a train, and also is where changes in the train's makeup, type, and schedule are made. Understanding how this report can be used, how you make changes in what your trains are made up of, and how you change what they are doing is a key factor in playing Railroad Tycoon.

A Train Report appears immediately after a train is purchased, and thereafter the report for any train on your railroad can be accessed from any display.

The Train Report quickly provides the following detailed information about your train.

•Train #: Train 1 is at the top of the Train Roster, number 2 is the second from the top, etc.

•Name/Class/Type: If this train has been awarded a name, it is shown (see Naming Trains, page 68). For trains that are not named, their freight class and type are shown instead. To change the train's type, see Train Types, page 70.

•Location: The approximate location of the train on your railroad.

•Locomotive type: The locomotive type pulling the train. If you wish to see detailed information about the performance of the locomotive on your train pull down the Engine menu and choose the option "Engine Info". To change the locomotive on the train see Changing

Locomotives, page 71. To retire a train entirely, see Retiring Trains, page 71.

•Maintenance: The expected maintenance cost of this train per fiscal period.

•Speed: The current speed of your train.

•Destination/Loading/Unloading: The destination is the name of the station to which this train is currently heading. To change the train's destination see Changing Destinations below, page 76. If the train is stopped and either loading or unloading, this is noted and a destination is not listed.

•Consist: Graphic icons of the locomotive and car types that currently consist this train. To change the train's consist, see Train Consist below, page 75.

•Cargo: Type or types of cargo on board.

•Priority Orders: If the train has priority movement orders, they are shown here. To give the train priority movement orders, see Priority Orders below, page 77.

•Priority Consist: If the train has priority consist change orders, they are shown here. To give the train priority consist orders, see Priority Consist below, page 78.

•Scheduled stops: Each train may have from 2 to 4 scheduled stops and they are listed here. To change the train's scheduled stops, see Routing Trains below, page 72.

•Consist Changes: Any consist changes planned at scheduled stops are planned here. To change the train's consist at stops, see Train Consist below, page 75.

•Wait Until Full Orders: If the train is to wait at a stop until fully loaded, that order is noted in this column. To place or remove this order, see Wait Until Full Orders below, page 78.

• Revenue Earned: This fiscal period to the left, and last fiscal period to the right.

To open a Train Report when you don't have a mouse, press the Tab key to move the cursor or Construction Box (Detail Display only) into the Train Roster window. The flashing cursor appears to the left of the first train in the roster. Press the *Selector* key to open the Train Report for this train. To select another train, move the cursor up and down the roster with the *Direction* keys.

To open a Train Report with the mouse, place the mouse pointer on the locomotive of the train that you wish to examine, and press *Selector 1*. Alternatively, you can place the mouse pointer on a locomotive on any of the displays and press *Selector 1*.

Naming Trains

Railroads got into the habit of giving their fastest and best known scheduled trains distinctive names. Crack named trains gave the public a symbol by which to judge the railroad and improved the morale of railroad employees. Most names were practical or had some historical or geographic significance, but others promised or advertised something more than just transportation. Examples of the latter types are the Orient Express (adventure), Flying Scotsman (speed), and the 20th Century Limited (modernity).

Trains that received names were generally passenger trains, but in many cases the faster scheduled freight trains were named as well. Trains maintained their names over many years, regardless of changes in locomotives and cars. The name was applied to a scheduled service, such as the New York to Chicago express, not to the specific locomotive and cars that made up the train.

In Railroad Tycoon you may have the opportunity to name certain of your trains as well, and within the limits of length, you may choose any title you think suitable.

The only way you can name a train is if that train succeeds in setting a new speed record for service between any two stops on your road. If one of your trains sets such a record you may type in the name you choose. However, train names cannot exceed a length of 24 letters, including spaces. Thereafter, the train's name appears on its Train Reports.

The passenger revenue earned by a train is increased by 25% if the train is named.

Once a train has been named, the name cannot be changed, unless the train sets a new speed record. If the train is retired, the name is also retired.

Train Classes

Railroads have to move a number of trains each day over a limited area. In order to help arrange these movements, they developed a system whereby trains are ranked, or classified, depending on the value of their cargos. When two or more trains want to move over the same track, the dispatchers controlling movements had a clear set of rules by which to determine the order of train movements. Generally, the higher classed trains moved first.

In Railroad Tycoon trains are classified as either mail, passenger, fast freight, slow freight, or bulk trains, with mail being the highest class, bulk being the lowest class, and the others ranked in between. Class is determined by the car types in the train. If only one type of car is in the train, then the class of that car type sets the class of the train. For example, a train made up entirely of coal cars is classified as a bulk train.

If more than one type of car is in the train, it is called a mixed freight, but its class is determined by the most common car type in the train. For example, a train containing a livestock car (fast freight), two grain cars (slow freight), and a petroleum car, is a mixed freight classified as a slow freight, because the most common car types were slow freights.

The class of the train is important when two or more trains are attempting to move over the same section of track. In this case the highest class train is given clearance by your dispatcher and moves first, and then the others move in descending class order.

Understanding and acting upon these relationships can improve the operation of your railroad. By keeping car types in trains of similar or adjacent classes, you can keep cargos moving at efficient speeds.

As explained later (see How Revenues Vary, page 82), for some cargos the time elapsed from pickup to delivery is more important than for others. It therefore pays to have similar cargos combined into trains and not mix all of the cargo types together.

For speed sensitive cargos such as mail and passengers, it pays to place them in smaller faster trains because the increased revenues more than pay for the increased cost per ton for the train operations.

For bulk and slow freight cargos that are much less speed sensitive, it pays to combine them into longer, slower trains. The bulk or slow

freight revenues are nearly the same whether delivered in several small fast trains or one long slow train. However, the long slow train has only one locomotive earning the revenue, while moving in several faster trains requires investing in several locomotives and crews.

Train Types

An additional method of defining trains was to assign them a type, such as local, through, express, or limited. The purpose of these types was to separate trains, not by what they were made up of, but by where they were intended to stop. By dividing its trains into types, a railroad made planning of movements easier, and also advertised to the public the various services these trains provided.

In Railroad Tycoon you also may define your trains by type. This is useful because the train type determines what stops the train makes, if any, in addition to those specifically scheduled.

You may make each of your trains a local, through, express, or limited train. The effects of these types are that they stop at more or less stations where they could possibly pick up or deliver cargo.

•Local: Stops at every possible station between scheduled stops.

•Through: Stops at every possible station between scheduled stops, except that it does not stop at Depots.

•Express: Stops at every possible station between scheduled stops, except that it stops only at Terminals between scheduled stops, not at Depots or Stations.

•Limited: Stops only where scheduled.

Regardless of type, a train always stops at those stations scheduled for it on its Train Report.

To change the type of a train, open its Train Report, pull down the Train Type menu, and choose the type you wish the train to be. The train's type is changed on the Train Report, and thereafter, the train makes stops according to its new type. Note that when a train is first built, it is automatically made a local type train and remains a local unless you change it.

The advantage to be gained from changing a train's type is that you can customize where it does or does not stop. In most cases you are raising a train's type to keep it from making unnecessary or unprofitable stops.

For example, a passenger train running from New York to Philadelphia could stop at several stations in between, all accepting delivery of passengers. But knowing that passenger revenues are higher for fast delivery over long distances, you change the type of the train to a limited type so that it skips all of the intervening stations.

Your passenger train now receives the revenue for a longer delivery, keeps its speed maximized by eliminating stops along the route, and remains full. If it made many stops at smaller stations along the way, the train would probably not be able to keep fully loaded.

Without this change, passengers may be picked up and delivered in several places along the route, slowing down the train's passage between the two cities, and probably collecting less revenue because the passengers only travel a short distance before being delivered.

Changing Locomotives

As the game continues locomotives age and their maintenance costs begin to climb. In addition, new locomotive types are invented that offer better service. Every locomotive needs to be replaced at some point, either because it is too old or because a newer type can do a much better job. When you decide it is time to replace a locomotive, you make the change from the Train Report.

To change the locomotive on a train, open the Train Report, pull down the Engine menu, and select "Replace Engine". From the list of locomotives available that appears, choose the engine you wish put on the train.

The change takes place immediately. The Train Report is updated to show the change, and the cost of the new locomotive is subtracted from your cash.

Retiring Trains

You may occasionally find that a train is no longer profitable, causing congestion on the line and slowing more important trains, or otherwise no longer worth maintaining. If you choose to do so, the entire train can be removed from your roster.

To remove a train from your railroad, open its Train Report, pull down the Engine menu, and choose the "Retire Train" option. The train disappears from the roster, its report goes away, and the numbers of all trains adjust to reflect the new order in the Train Roster.

Routing Trains

The routing, or scheduling, of trains is one of the most important parts of railroad management. An efficient schedule insures that cargos are picked up and delivered in a timely manner, and that the train operation costs for providing service are kept down. A great many extra trains insures timely service, but run up costs so much that railroad profits shrink.

In practice, the master of the road provides the locomotives and cars that the dispatcher requires to meet the demands for service. The dispatcher receives requests for service from industry and uses this information to plan what trains are required.

Railroads found that by regularly scheduling certain trains, or by arranging with important customers to provide service at specific times, passengers and shippers could make their plans to ship or receive according to the schedule. A regular schedule also made it easier to plan the movement of trains, as dispatchers along the line could expect certain trains to arrive in their divisions at scheduled times.

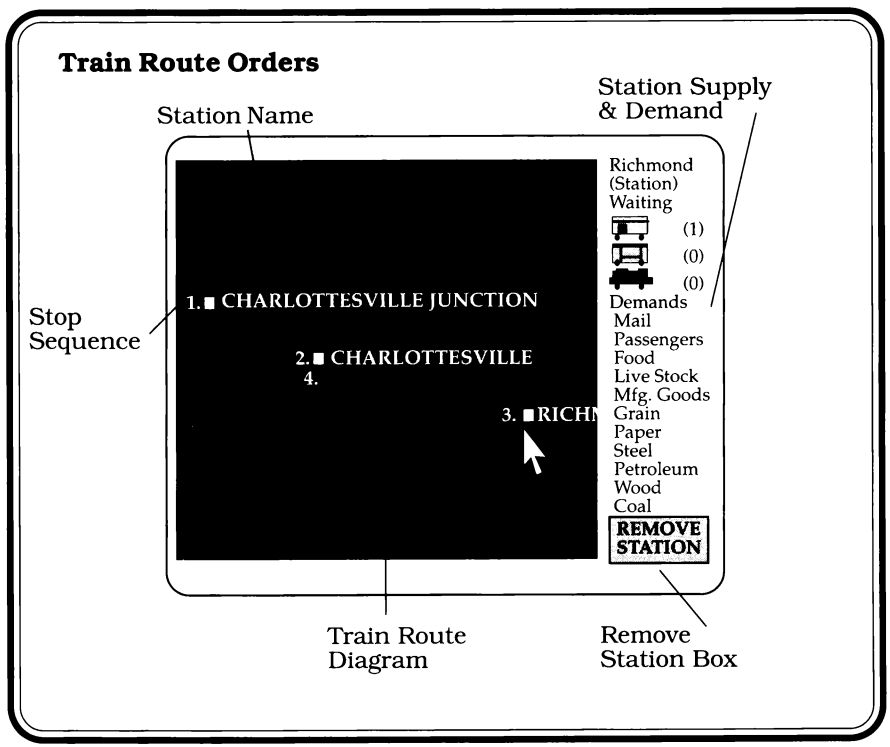
In Railroad Tycoon, the scheduling of your trains is also very important. By examining the Shipping Reports of your stations, you learn what cargos are available for shipment, and where those cargos can be delivered. Your task is to build trains of the proper cars to carry the available cargo, and then rout the train so it moves from stations where cargos are supplied to stations where the cargo can be delivered.

For example, in our tutorial game both Richmond and Charlottesville supply and demand passengers. So, a train of passenger cars can run back and forth between these cities picking up passengers at either city and delivering them at the other. To do this, you must build a train of a locomotive and at least one passenger car, and then route the train to run from Charlottesville to Richmond. Having been scheduled, this train runs between the two cities forever, or until you step in to make changes.

When a new train is built, it is automatically given a route between the station at which it was built and another station on your railroad. This is shown on the Train Report. You are rarely going to want your train to run this exact route, so the route needs to be changed, and this is done from the Train Report.

As an example, assume you are running the Charlottesville & Richmond Railroad from the tutorial. You notice that the supply of coal is building up at Charlottesville Junction, and that a train could take this coal to a Steel Mill in Charlottesville, pick up steel there and take it to a factory in Richmond, and pick up manufactured goods there for delivery to Charlottesville. You decide to change the route of Train #3, now scheduled to run back and forth from Charlottesville to Charlottesville Junction.

To change the route of Train #3 using the mouse, open its Train Report and place the pointer on the open line below Charlottesville in the section marked Scheduled Stops. Press *Selector 1*, and the route diagram for this train opens.



Notice that the current route of this train is marked. The number 1 next to Charlottesville Junction notes this station as the first station on the route, and the number 2 next to Charlottesville notes it as the second stop. Move the mouse pointer directly below the box marking the station at Richmond, and the information regarding supply and demand there appears to the right.

With the pointer below the Richmond station box, press *Selector 1* to make Richmond stop number 3. Notice that the station box turns to the color of scheduled stops, the track into the station turns the color of an active route, and that the number 3 appears next to the station box. Richmond has now been added to this train's route as scheduled stop #3. To check

this, press *Selector 2* which returns you to the Train Report. Notice that scheduled stop #3 is indeed listed as Richmond.

Since you want this train to return to Charlottesville from Richmond, you have to add Charlottesville to the route again as stop #4. Place the mouse pointer on the open line below Richmond in the Scheduled Stops section and press *Selector 1* to open the route diagram. Move the mouse pointer under the box for the Charlottesville station and press *Selector 1* again. The number 4 appears with the number 2 next to the Charlottesville station box, noting that this station is stop #4 as well as stop #2.

Return to the Train Report by pressing *Selector 2* to be sure the four scheduled stops are arranged in order from 1 to 4 as Charlottesville Junction, Charlottesville, Richmond, and Charlottesville again.

To change the route of Train #3 when playing without a mouse, first open the Train Report. Note the highlight box that appears over the number of the scheduled stops at the left of the report. This highlight box can be moved up and down with the *Direction* keys. Use a *Direction* key to move the highlight box to the empty row below stop #2, Charlottesville.

Now open the Schedule menu at the top of the report, and choose the "Change Station" option. Press any one of the *Direction* keys until the station box at Richmond is highlighted. When the Richmond box is highlighted, press *Selector 1*. This returns you to the Train Report where Richmond is listed now as stop #3.

Repeat this procedure to select Charlottesville as stop #4.

As the final step in arranging this route, pull down the Train Type menu and choose the "Limited" option. This makes Train #3 a Limited train and it stops only at stations on its route. This makes no difference now, but if more stations are added at a later time, it prevents needless or wasteful stops.

Train #2 is now scheduled to run its route between these four stations. After it completes its route, reaching Charlottesville for the second time coming back from Richmond, it returns to the first station on its route and begins the route all over again.

Train Consist

The number and types of cars that make up a train are called its consist. The dispatcher plans the consist of a train to insure that the correct types of cars are available to carry waiting cargos. At stops along its route a train may change its consist several times as it makes pickups and deliveries.

In Railroad Tycoon, you may arrange for regularly scheduled consist changes to take place at stops along a train's route so that the train contains correct cars for cargo pickups. You can coordinate the changes in the train's consist with its scheduled stops, so that the train may carry several different types of cargos in one circuit of its route. If all the cars needed were put on at the same time, only some of the cars would be needed at one time, and the others would be just extra weight for the locomotive to pull.

For an example of planning a train's consist changes, return to the Train Report for Train #3 of the Charlottesville & Richmond whose schedule was just rearranged in the section above.

Train #3 is now scheduled to run to four stops to take advantage of several related industries. Coal from Charlottesville Junction can be taken to the steel mill at Charlottesville and converted into steel. The steel from Charlottesville can be taken to the factory at Richmond and converted into manufactured goods which can be delivered to Charlottesville. But the train cannot take advantage of these industries if the consist remains one coal car because the coal car cannot carry steel or goods.

To change the consist of Train #3 using the mouse, open its Train Report. Place the mouse pointer on the line showing "no changes" to the right of the scheduled stop Charlottesville Junction under the heading "New Consist". Press *Selector 1* and choose "Coal Car" from the Add Car menu that appears. Note that a coal car icon appears on the line where "no changes" was previously showing.

You may also use the mouse to repeat the train's current consist from the top of the report in any row of the New Consist area. Place the mouse pointer on the row where you want the consist repeated and press *Selector 2*. This is useful if you want to add cars to the current consist without rebuilding the entire train.

To change the consist of Train #3 when playing without the mouse, open its Train Report. Note the highlight box at the left hand side of the report under Train Orders. Move this highlight box to stop number one, Charlottesville Junction by pressing the *Direction* keys. When the box is on the "1", pull down the Consist menu and select Coal Car from the options. Since this is the only car making up the consist at this station, choose the "No Thanks" option to get back to the report.

The presence of the coal car indicates that the consist orders for this train are to remove all other cars on the train when it reaches this stop and put on one coal car. Repeat this process and place a steel car at the second stop, Charlottesville, and a goods car at the third stop, Richmond. Leave the consist at the fourth stop, Charlottesville again, unchanged.

You have now arranged the consist changes necessary for Train #3 to take advantage of the industry along its route. It is scheduled to carry coal from Charlottesville Junction to the steel mill at Charlottesville. The steel mill uses the coal to make steel and your train puts on steel cars there to carry the steel on the the factory at Richmond. The factory takes the steel and converts it into manufactured goods. Your train again changes its consist to a goods car so it can carry the goods back to Charlottesville for delivery.

When your train reaches Charlottesville for the second time, it has completed its route and returns empty to Charlottesville Junction to start the route over. At the start of its route it replaces its goods car with a coal car and starts the cycle over again.

Changing Destinations

As you monitor the operations of your trains, you may wish from time to time to change slightly the route of a train. This may be useful when a bridge is washed out on the route, or because a supply of a cargo further down the route has diminished, or for other reasons. By changing the destination of the train, you can have it skip a wasteful stop or avoid a wreck.

In the Train Orders section of the Train Report, under Scheduled Stops, the next city to which the train is moving, its destination, is highlighted. You may change this destination to another city on your railroad, regardless of whether the new destination is on the train's list

of scheduled stops or not. To temporarily change the destination to a city not on the current route list, see Priority Orders, page 77.

To change your destination to another scheduled stop when playing without the mouse, move the highlight box to the city to be the new destination. Pull down the Schedule menu and choose the "Go To Station" option. The highlight changes from the old destination to the new city, marking it as the train's next destination.

To change your destination to another scheduled stop when using the mouse, place the mouse pointer on the name of the stop you wish to make the new destination for the train and press *Selector 2*. The new station is highlighted, signifying that it is the next destination for this train.

Priority Orders

You may find it occasionally useful to have one of your trains temporarily change its route to avoid a washed out bridge, to pick up a Priority Shipment, or to take advantage of a temporary change in the supply or demand of a cargo nearby.

For example, a train that was unable to fill up with coal to take on to a steel mill may be rerouted by a Priority Order to another nearby city where coal has been sitting unused. By rerouting your train to pick up this coal, you fill it with coal more quickly than having it wait at its first coal stop until full.

To temporarily change the destination for a train to a city not on its list of scheduled stops, you must give it Priority Orders. This change is made from the Train Report.

To give a train Priority Orders using the mouse, place the mouse pointer on the space below Priority Orders to the right of the "P" symbol, and press *Selector 1*. On the route diagram that appears, move the mouse pointer to the station box for the city which you wish to be the new destination and press *Selector 1*. A "P" symbol appears next to the city you have selected, noting this station as a priority destination. Press *Selector 2* to return to the Train Report.

To give a train Priority Orders when not using the mouse, use the Direction keys to move the highlight box under the "P" symbol below Priority Orders. Pull down the Schedule menu and the route diagram appears. Use the *Direction* keys again to highlight the station that you

wish to be the priority destination, and press *Selector 1*. This returns you to the Train Report.

Back on the Train Report, you see that under Priority Orders the new destination is listed, and the bottom part of the Train Orders section is screened out. This signifies that the normal train orders have been overridden. Once the train reaches its priority destination, it returns to its normal route, picking it up where it left off.

Priority Consist

Occasionally during play you may wish to temporarily change the consist of a train. This is especially useful when attempting to pick up a Priority Shipment, see page 78.This type of change is made from the train's Train Report.

To give a train a Priority Consist order when using the mouse, move the mouse pointer onto the line below Priority Consist marked "no changes", and press *Selector 1*. This opens the Add Car menu from which you may choose a car to be added to the Priority Consist. When a car is selected, the menu goes away, but you can call it back by placing the pointer on the same line again and pressing *Selector 1*. To delete a car in the Priority Consist, place the pointer on it and press *Selector 1*, and it is removed.

To give a train a Priority Consist order when not using the mouse, use the *Direction* keys to move the highlight box onto the "P" symbol to the left of the Train Orders section, and pull down the Consist menu. This act automatically clears all of the existing cars, if any were present, from the Priority Consist line. Choose from the Add Car menu the cars you wish to add to the Priority Consist.

The cars of the Priority Consist are placed on the train at its next stop, overriding any previously scheduled consists. The train proceeds along its normal route (unless given Priority Orders) and at the second station it stops at, its normal consist orders again go into effect.

Wait Until Full Orders

For sufficiently large customers, railroads put on unit trains, or trains dedicated to this one shipper. A common example are coal trains, sent to one mine to load coal and carry this cargo directly to a port, steel mill, etc. These trains were not scheduled to arrive and depart by timetable as other trains, but were sent to be loaded, and then moved

when loading was complete. In this way the railroad could arrange for proper locomotives and crews knowing that they would be moving a full train.

In Railroad Tycoon you may also arrange that a train wait to move until fully loaded by giving it Wait Until Full Orders. Trains given this order do not move until every car in the train is fully loaded or until the order is lifted. Using these orders you can improve the efficiency of your railroad, especially when the train is to pick up a cargo to be converted and carried on to another stop on its route.

For example, consider Train #2 on the Charlottesville & Richmond Railroad of the tutorial. This train is scheduled to make four stops and change its consist three times. The coal it loads at the start of its route is converted to steel which is carried to a factory. At the factory the steel is converted to manufactured goods which are delivered back to Charlottesville.

As noted later in the section about cargo conversions, the conversion process is 100% efficient. If the train starts with 40 tons of coal, this converts to 40 tons of steel, and this converts to 40 tons of goods. For this reason, it is beneficial to begin with 40 tons of coal, thereby guaranteeing full loads at every stop.

For cargos where no conversion is to follow, or where the cargo is very speed sensitive, such as mail, waiting until full is less valuable or actually wasteful.

To order a train to wait at a stop until fully loaded, open its Train Report. When using the mouse, place the pointer in the space between the stop number and the name of the stop under Scheduled Stops and press *Selector 1*. Use the same procedure to remove wait orders from a train that is already waiting.

When playing without the mouse, use the *Direction* keys to highlight the number to the left of the stop where you wish the train to wait. Pull down the Schedule menu and choose the option "Wait" to order a train to wait until full, or choose the option "Don't Wait" if the train is already waiting and you wish that it no longer do so.

A "W" appears to the right of the stop number signifying that this train is ordered to wait until full at this stop.

Train Wrecks

The accidental wrecking of trains has been a part of railroading from its start. The severity of accidents ranged from commonplace derailments to spectacular head-on collisions. Wrecks resulted from mechanical failure and bad weather, but more often from human error.

The negative effects of a major wreck included not only the possible loss of passengers, crew, cargo, and equipment destroyed, but also a drop in demand for the railroad's services. Passengers and shippers looked to alternative railroads or transport rather than risk the trains of a demonstrably incompetent railroad.

In Railroad Tycoon you can suffer train wrecks due to washed out bridges or to collisions. Trains that cannot be halted or rerouted in time plunge off of washed out bridges. When you override block signals, you run the risk of letting too many trains into a block and causing a collision.

If one of your trains goes over a washed out bridge or two or more of your trains collide, the result is a train wreck. When a train wrecks, the locomotive, cars, and cargos that make it up are destroyed and removed from your railroad. You receive no compensation.

In addition, all cargos of the same type as those lost on your train immediately disappear from every other train on your railroad. Shippers have their cargos taken off your trains immediately.

Also, all supply of these same cargos disappears from the stations on your railroad, as shippers find other ways of moving their goods.

Eventually calm is restored and the cargos once more become available, assuming you suffer no more wrecks.

Revenue and Cargos

Railroad revenue comes from two main sources, passenger fares and freight charges. A passenger boarding a train in Chicago pays a fare for being conveyed to Detroit. A steel mill in Pittsburgh pays a freight charge for delivery of a load of coal from Scranton.

In these examples the railroad is responding to the supply and demand for passengers and coal. The passenger in Chicago represents a supply of passengers there. The coal piled up in Scranton also represents a supply, this time of coal. The desire of the passenger to go to Detroit represents the demand for passengers in Detroit, just as the mill's desire for coal represents demand for coal in Pittsburgh.

Since steel mills in Railroad Tycoon also demand coal, a steel mill within the radius of a Pittsburgh station on your railroad would be represented by the demand at that station for coal. If your railroad has track connections to a station near Scranton that has a coal mine within its radius, you can make money by having a train take coal cars to the Scranton station, load coal, and then deliver it to the Pittsburgh station.

The key to a good start and profitable existence in Railroad Tycoon is understanding the relationships between the industries that create the supply and demand for cargo, the stations that act as shipping and receiving points for industry, and the revenue you earn by having trains carry cargos from stations that are shipping to those that are receiving.

Earning Revenue

Revenue is earned by loading your trains at a station that is a supply source for a cargo and then routing the loaded train to a station that has demand for that cargo. When a train stops at a station to make a delivery, several things take place to mark the event.

First, in the World View window at the top right of your screen, an announcement appears describing the train's arrival. The announcement lists the time of the arrival, the train's type and number, the name of the station, the cargos delivered, and the revenue received.

Second, when the cargo is delivered, the car icons on the Train Roster switch from loaded to unloaded.

Third, your cash balance shown in the bottom of the Information window increases by the revenue received.

And fourth, the bottom of the Shipping Report fills in green proportionally to the revenue earned.

How Revenues Vary

Some cargos are more valuable to railroads than others because some customers are willing to pay higher fees for faster service. For this reason railroads develop a hierarchy of trains offering different services and customers can select the type of service that suits them best.

In general, mail, passengers, and express packages attract the highest fares because they are given the best service. The fastest freight trains earn slightly lower fees for speedy delivery of important cargos such as perishable foods. Bulk cargos such as coal have the lowest rates but are still profitable because railroads can efficiently carry them in huge quantities.

On your railroad you can arrange some differentiation of service to improve profitability by making up trains of the same or neighboring freight classes, by carefully setting train types and routes, and by understanding how freight rates are determined.

The revenue earned for delivering cargos can vary between stations (see Shipping Reports, page 58), cargo classes, worlds, and over time. For the Western United States, revenues are higher than normal for east-west deliveries and lower than normal for north-south deliveries. The other worlds use the normal rate structure. Over time, freight rates tend to fall. To compensate, you must run bigger, faster, and/or greater distance trains.

The revenue for mail is most sensitive to time and distance. The faster it is delivered once picked up and the farther it is carried, the higher the revenue per ton. Passengers are less sensitive to time and distance, fast freight is even less sensitive, and so on down to bulk cargos that are insensitive to time and distance. It doesn't matter how far you carry bulk cargos or how fast. You are paid a strict fee by the ton.

Cargo Types

The economies of the United States, England, and Europe are each represented by 11 cargos that can be carried by railroads. Some cargos are unique to one world, and some are available in all three. The 11 cargo types are separated into 5 freight classes, each with a distinctive color as described in the Technical Supplement: mail, passengers, fast freight, slow freight, and bulk.

The cargo class determines the revenue earned for delivery (as explained in the section above), how long it takes to load or unload a car, the weight of a full car, and the weight of an empty car. Mail class cars take the least time to load or unload, then passenger cars, etc., down to bulk cars that take the longest time. Mail cars are the heaviest when empty, then passenger cars, down to bulk cars that are the lightest car type when empty. Conversely, bulk cars are the heaviest when full, then slow freight, up to mail cars that are the lightest when full.

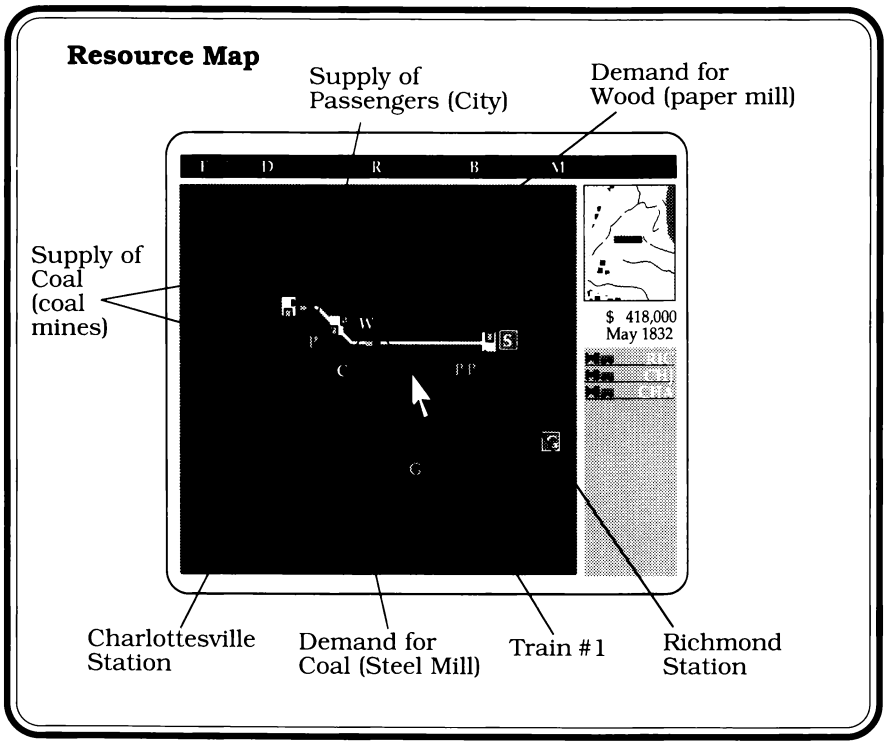
By being aware of these differences in cargo types when loading, riding empty, etc., you can improve the efficiency of your railroad by carefully arranging the makeup of your trains. For example, a train made up entirely of mail cars or mail and passenger cars, loads and unloads much faster than the same train if a slow freight car is also in the consist. Thus a mail train moves faster.

The supply and demand for cargos is derived from cities, villages, and industries as shown on the World Economies Chart found on the Player Aid Card. Be aware, however, that it takes more than one village by itself to have any significant effect. The aggregate of supply and demand from several villages is needed to make rail service worthwhile.

Resource Map

To help you see where cargos are supplied and in demand, you can convert the Local Display into a Resource Map. When you do this, the geography of the map is removed, and new one-letter symbols appear to mark sources of cargo supply and demand. You can call up this Resource Map while planning and see at a glance the economic situation in your vicinity.

To access the the Resource Map, center the Area or Local Display over the part of the map that you wish to examine and pull down the Display menu. Choose "Options" from this menu. From the Options menu, choose "Resource Map", and a check mark appears next to that option. The check mark indicates that the Resource Map is now taking the place of the normal Area and Local Displays. Press any *Selector* to make the display change to the Resource Map.



The letter symbols that appear on the map indicate a source of supply for a cargo at the symbol's location. For example, "C" indicates a source of coal which must be a coal mine.

A letter symbol on a square background indicates a source of demand for a cargo. For example, a "W" on a square background indicates a source of demand for wood, most likely a paper mill.

If the Shipping Reports of your stations are blocking your review of the map, you can turn them off from Option menu as well. When the Shipping Reports are visible, their menu option is checked. Choose "Shipping Reports" from the menu to turn off the check mark, and this makes them disappear from the display.

To put the Resource Map away and return to the normal map displays, reverse the procedure for accessing the Resource Map and remove the check mark from the Option menu.

Cargo Conversions

Certain industries developed a special relationship with railroads because raw materials brought to them by rail were converted into products that were in turn shipped out by rail. For example, cattle brought by train to packing plants was converted to frozen or canned meats and then shipped by rail to markets. In this case an important rail cargo, processed meat, does not exist as a naturally found resource.

In each world of Railroad Tycoon there are a number of cargos that come into being only after the conversion of another cargo at an industry. These types of cargos can offer special opportunities for revenues because the same cargo can be carried several times.

As shown on the World Economies Chart found on the Player Aid Cards, some industries demand one cargo and then convert it to another that they now supply. For example, a carload of coal brought to a station that serves a steel mill is converted into a carload of steel. A carload supply of steel is then available at the station. This steel could then be taken to a factory's station, converted to manufactured goods, and then carried finally to a station demanding goods. In this case, one carload of coal is converted into two successive carloads, each earning revenue.

Priority Shipments

The majority of railroad trains are run according to timetables. In this way the railroad can schedule its stops and equipment needs for efficiency, and its customers can confidently make travel and shipping plans. However, railroads are often requested to provide special trains for excursions, emergency shipments, etc. These special trains are usually quite profitable because the railroad would not disrupt its normal service to accommodate the specials if they weren't.

Occasionally during play your railroad can receive requests for delivery of Priority Shipments. When delivered quickly they can be very lucrative, but at other times the pickup and delivery points are placed such that the disruption to your regular service may be too great. When a priority shipment appears, take a few moments to decide whether the delivery is worth your trouble.

You are notified by a message window when a Priority Shipment becomes available. The message tells you the cargo type to be delivered, where it must be picked up, and where it is to be delivered.

In addition, a letter P appears in the Shipping Report of the station where the shipment is waiting, and a letter *D* appears in the report of the destination station. The color of these letters corresponds to the color of the freight class of the shipment. For example, if the shipment is food, classified fast freight, the letters are the color of fast freight, as described in the Technical Supplement.

When a Priority Shipment appears, the fee for delivering it also appears in the bottom of the Train Roster window. The amount shown is what your railroad would earn for delivery at that instant. Unfortunately, that fee continually shrinks in size as time passes, but many

are so large as to be quite substantial even after much time has passed. If the delivery fee reaches $20,000 the shipment is cancelled and all further references to it are removed.

In order to pick up a Priority Shipment, a train containing a car capable of carrying the priority cargo must be routed to the station where it is waiting. When the train stops, the Priority Shipment is loaded on board. The color of this train's locomotive icon on the Train Roster changes, to indicate the shipment is on board. Note that every train containing the correct type car that stops at this station picks up the shipment, not just the first.

Priority Shipments may be handed on to other trains. Whenever a train carrying the shipment stops at another station, it "stocks" that station with the shipment. Thereafter, any train containing the correct type car and stopping at this "stocked" station, also picks up the shipment.

Building Industry

Recognizing the long run benefit to themselves and the economic region they served, railroads often took steps to encourage industry along their system.

You may find at times that your railroad could substantially benefit from new industry in the right area, such as placement of a steel mill near a large coal area, or a food processing plant near a grain area. A judicious investment such as these, or the provision of a missing link for a chain of cargo converting industries could provide a handsome return.

As an alternative to waiting for industries to grow along your railroad, you may speed the natural process by attempting to invest in specific industries. You may try this at any time. The industries that may be built in each world are shown on the World Economies Chart, found on the Player Aid Cards.

To build a new industry, go the Detail Display. Center the Construction Box in the area where you want the industry to appear and pull down the Build menu. This menu lists the industries available to be built. Choose the industry you desire. If a suitable site was found in the area, the industry is built and the Construction Box moves to the site to point it out. If no suitable site is available, you are informed that the industry can not be built.

The search for a suitable site is carried out by your engineers. You cannot choose the square you desire. If a suitable site cannot be found within 3 squares of where you placed the Construction Box, the investment does not take place. In this case you may elect to move the Construction Box to another location and try again.

As with other industries in the game, ones you build may also go out of business or change type.

Operating Trains

The operation of a train is in the hands of two people, the locomotive engineer who sets the train's speed, and a dispatcher who determines when and where the train moves.

Railroad locomotives only move straight ahead or in reverse, they have no steering wheel. The engineer, sitting in the locomotive's cab and watching the track ahead, uses the throttle to adjust the train's speed to reach points along the line as scheduled. He assumes that the tracks ahead are correctly arranged to guide the train to its proper destination.

In Railroad Tycoon, all of your engineers drive like Casey Jones on a good day. When the tracks are clear, they open the throttles wide on your locomotives and make the best possible time.

The dispatcher's job is to be sure that the orders given the engineer before the train pulls out put his train at the right place at the right time, that the tracks are properly arranged as needed, and that the movement of all trains is accomplished safely.

You perform the first two functions of the dispatcher on your railroad (scheduling and switching) on the Train Report. When you set a train's route on the Train Report, the division dispatchers on your road schedule departures and arrivals, and arrange for the necessary track switching.

The third function of the dispatcher, providing safe operation, is more complicated. The safe movement of trains is controlled by the dispatcher on a large schematic diagram of the railroad. The location of each running train is continually updated on the board. The entire road is divided into blocks, and the movement of trains into blocks is controlled by signals, like traffic lights. A train is not allowed into a block until trains ahead of it are out of the block, thus preventing the chance of collision.

On your railroad, safety is assured by signals that are automatically set up when stations are built. However, relying on these signals alone may result in very conservative, inefficient operation. In your roles as construction engineer and dispatcher, you may improve the efficiency of your road for minimum cost by selective placement of additional signals and double tracks. You may also step into the management of individual trains by pausing them or opening blocks that would normally be closed.

How Signals Work

The rules for signals apply only when the reality option "Dispatcher Operations" is in effect.

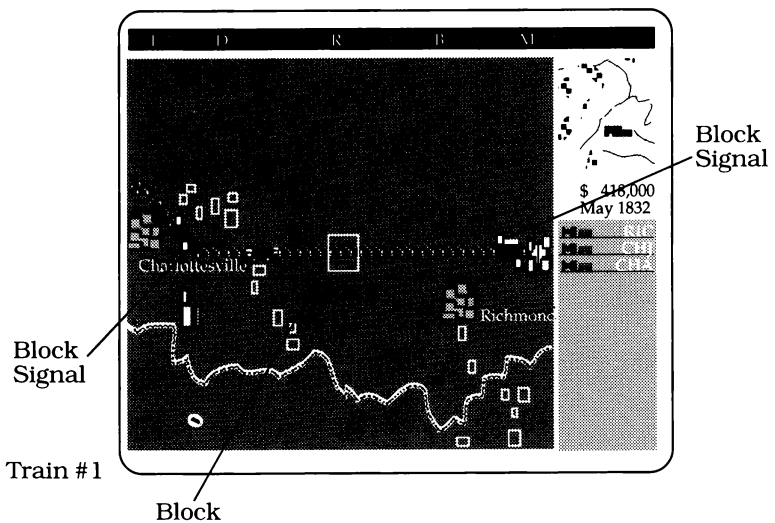
Each station or signal tower on your railroad comes equipped with a set of track signals, one signal on each side of the track that passes through the station. These signals control the movement of trains past them in either direction. A Go signal allows an approaching train to pass, while a Stop signal stops it. Refer to the Signals Chart on the Player Aid Card for a description of Go and Stop signals.

All of the track stretching from one signal to the next along the line is considered a block of track. Only one train at a time is allowed in a block of single track. When a train enters a block of single track, the signals at both ends of the block turn to Stop preventing any more trains from entering. When the train reaches the end of the block, the signals at both ends turn to Go and once again allow entry.

Note that the boundaries of a block are set by the placement of signals. In cases where tracks split at a switch, the tracks that continue on from the switch remain part of the original block unless a signal is placed after the switch.

For example, assume your railroad lays track between Richmond and Charlottesville. You then place a switch between these two and run another track section north to Washington, D.C. If you don't add any more signals, all of the track between the three cities exists as one block, and only one train can normally run on all of this track at a time.

Block Signals



By placing another signal just past the switch on the way to Washington, you separate the old block into two blocks, one that runs between Richmond and Charlottesville, and one that runs between the switch and Washington.

If all of the track in a block is double track, the signal system allows two trains at a time to be in the block, regardless of their relative position.

Every set of signals on your railroad comes with a signalman in a tower. If a train approaches a tower and the block ahead is empty, the signal is set to Go. When the train enters the block, the signalman telegraphs the dispatcher and the dispatcher marks the train in the new block on his board. The dispatcher telegraphs the signalman and his counterpart at the other end of the block to close the block. Both signalmen set their block signals to Stop and no further trains are allowed in. When the train inside reaches the other end of the block, the signalman at that end telegraphs the dispatcher, and he gives the okay to reopen the block.

Recognizing what track constitutes a block can become complicated when tracks begin branching out. Signals do not come with switches. All track that extends off of your mainline from a switch remains part of your mainline block unless you add a signal tower to the branch to separate it.

Signal Towers

A block that separates two stations a great distance apart may be so long that trains are running very inefficiently between them. While one train is traveling across the block, the second is sitting at a Stop signal at one end.

One thing you can do to speed the relative movement of trains in this situation is divide the big block into smaller blocks by adding signal towers along the line. The mathematics of calculus say that the more blocks you divide the big block into, the faster two or more trains can move between the ends of the original block. But signal towers are expensive. You must find an economical compromise between the number of towers to add and the increase in train speed that would follow, versus the cost of the those towers.

To build a signal tower, go to the Detail Display and place the Construction Box on the track section where you want the tower to appear. Pull down the Build menu, choose the option "Build Station", and then choose the option "Signal Tower" from the menu of station choices. The new tower appears within the Construction Box on the display and the signals immediately begin affecting the movement of trains.

A signal tower consists of a set of signals and a section of double track. An unlimited number of trains may wait adjacent to a signal with no risk of collision.

Signal towers cost $25,000 and may only be built on existing straight track sections. They may not be built on curved, switch, bridge, or tunnel sections.

Overriding A Block Signal

The dispatchers on your railroad never make mistakes, but they are also very conservative. There may be times on your railroad when more liberal train operations can result in faster, yet safe, service. In your role as chief dispatcher, you may open blocks that are normally closed to get stopped trains moving. This action is useful when a fast train is already in a block and a slower train is waiting stopped behind it, or when one train is inside a complicated block of switching tracks and a train that is waiting has a route that doesn't interfere with the moving train.

You may override a signal from any display except the Regional Display. On the Detail Display, the Construction Box must be centered on the signal you plan to change.

If you are using the mouse, place the pointer on the signal you wish to override and press *Selector 1*. A Signal window opens showing the track, tower/station, and the two signals, one in each direction. The two signals are at either end of the building and control the blocks that they are adjacent to. Inside the Signal window, place the mouse pointer on the signal you wish to override and again press *Selector 1*.

To override a signal when you don't have a mouse, place the cursor on it and press the *Signal* key. This opens a window that requests that you indicate the direction of the signal you wish to change. Press the *Direction* key that corresponds to the direction of signal. For example, if the signal you wish to change is on the west-

bound side of a station placed on a straight track running east to west, you would press the due west *Direction* key to override that signal.

In both cases, another menu opens offering you the choices "Normal", "Hold", or "Proceed".

Choosing "Normal" restores normal signal operation: stop if the block is full, go if the block is empty.

You may override existing signals with either menu choices "Hold" or "Proceed". How these overrides are graphically displayed is shown on the Signal Override Chart in the Technical Supplement.

A signal overridden with "Hold" stops all trains until the signal is overridden again back to "Normal" operation.

A signal overridden with "Proceed" allows the next train through, but then automatically returns to normal operation.

The menu choice "Normal" returns a currently overridden signal back to normal operation.

Pausing Trains

Railroads find it desirable on occasion to hold up the movement of a train. A train could be held to prevent an accident or to allow a following train to pass.

On your railroad you may also find it desirable to temporarily halt a train. In addition to the above reasons, you may wish for a train to wait outside a station until a supply of cargo has built up for the train to carry away.

You may pause a train by either changing the signal that it is approaching (as explained in the section immediately above, Overriding Signals), or by ordering the train itself to pause. Changing a signal to "Hold", however, stops all trains that reach this signal. Pausing an individual train stops it alone.

You pause an individual train from the Train Roster.

If using the mouse, move the mouse pointer to the line below the train you wish to pause, and press *Selector 2*. The line below the train changes color or pattern to indicate that the train is ordered to pause.

If you don't have a mouse, use the *Tab* key and *Direction* keys to move the cursor next to the locomotive of the train you wish to pause and press the *Hold* key.

The change in the line below the train indicates that this train is going to stop moving at the next signal it reaches and move no farther until you remove the pause order.

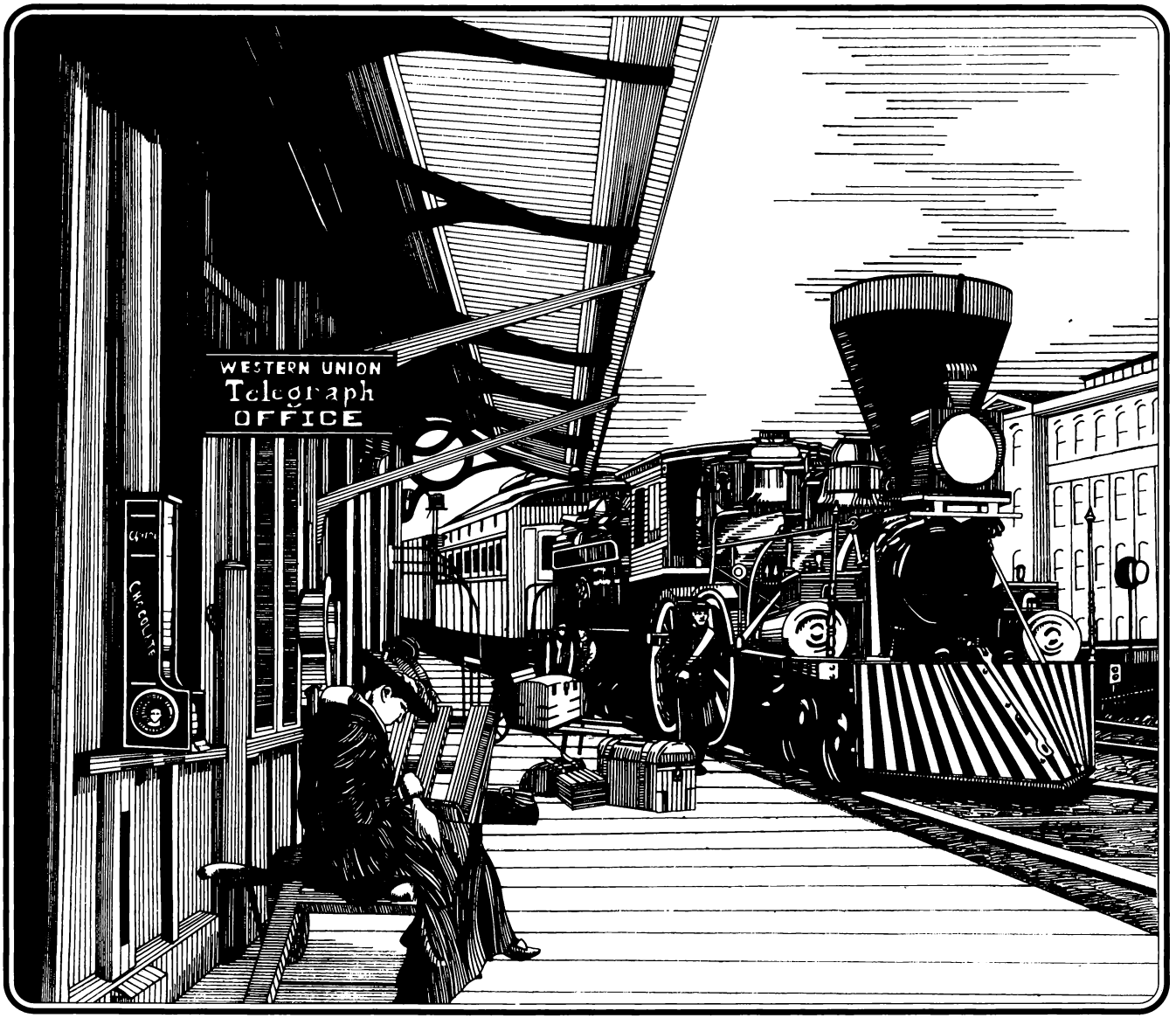
To remove the pause order with either the mouse or keyboard, repeat the procedure for pausing. The line reverts to its normal appearance and the train resumes normal operation.

No Collisions Mode

When you are first learning to play Railroad Tycoon, it may be useful to play without having to worry about signals and collisions. This may allow you to concentrate on learning other aspects of the game.

To play without the possibility of collisions and be able to ignore the system of blocks and signals, choose the "No Collision" option when you are setting the parameters of your railroad.

The effects of the No Collision Mode are that trains can never wreck. Even though the signal system does not work, trains do not collide. When two trains meet or pass each other, the lower class train pulls over to a siding and halts. This is handled automatically by your dispatchers and you don't have to make any preparations. When the higher class train has passed, the halted train gradually begins moving again. A disadvantage to this mode is that a low class train may be halted many times when trying to complete its route.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4
THE RAILROAD BUSINESS

Railroads were one of the great capital enterprises of the industrial age, requiring huge investments in the global construction projects that they became. Before the first train could run, costly and extensive preparation was required: miles of roadbed prepared, bridges built where necessary, rails purchased and laid down, minimum station facilities built, locomotives and rolling stock made ready.

The money that made railroads possible came from several sources, including investors subscribing to stock shares and thereby becoming partial owners of the enterprise, investors buying long term bonds, short term bank loans, and profits generated by the railroad once operations started.

When a new game of Railroad Tycoon begins, you have already sold part of the public on your dream and attracted investors who have bought enough of your stock and bonds to give you a start. As play continues you may have the opportunity to sell additional stock, borrow more money, buy back stock into the treasury, and buy back bonds.

RAILROAD CAPITALIZATION

Initial Capital

The initial capitalization of your railroad is $1,000,000, $500,000 obtained from selling bonds and $500,000 obtained from investors who have bought 100,000 shares of your stock at $5 per share. This is the money you begin your railroad with.

Additional Stock

As time passes and your railroad grows, new stock, in addition to the 100,000 outstanding at the start, may come into existence in two ways: new stock issues or stock splits.

New stock may be issued only when you build a station into a new city. As a bonus for the new railroad connection, the local city leaders may offer to buy 10,000 new shares from you at the current market

price. If this occurs, you have the option of making the sale or not. Choose the option you wish from the menu that appears. The stock sold consists of newly authorized and registered shares that previously did not exist. The sale increases the outstanding shares in the public's hands by 10,000.

A 2 : 1 stock split occurs at the end of any fiscal period in which your stock price reaches $100 per share or higher. At the beginning of the next year, the number of shares is doubled and the price of the new shares is halved from the price of the old. For example, if the price at the end of the year of 140,000 shares is calculated to be $110, the stock splits resulting in 280,000 shares priced at $55 per share.

Stockholder Happiness

Regardless of the fact that the railroad you are running is your dream and that your decisions have made it the great enterprise that it is, you nevertheless work for the stockholders and they are a cynical bunch. Your stockholders are only happy if the stock price is higher than last year and headed higher. If the stock price doesn't increase they become unhappy, and they can become quite angry if by some shocking circumstance the stock price should actually fall.

You retain office as president of your railroad so long as the stockholders are at least content with the job you are doing. Their happiness is measured at the end of each fiscal period when the stockholders calculate their return on investment (ROI) averaged over the last 5 years. The higher this number, the happier they are. If for several periods in a row this number doesn't increase, or actually decreases, the stockholders become progressively angrier.

If stockholder patience runs out, they may throw you out of office and replace you as railroad president. You are forcibly retired and your management of the railroad ends. However, **if at least 50% of your railroad's stock is in the treasury, you cannot be fired.**

Bonds

Your railroad starts with an outstanding 4% bond of $500,000. Further bonds are sold and bought back in $500,000 increments.

Each bond sold has an annual interest rate which is subtracted from your railroad's cash at the end of every December. The interest rate on any new bond you wish to sell depends on the economy and the number of bonds you have outstanding as in the table below.

Once the current interest rate reaches 9%, you may not sell any further bonds, regardless of how many you already have outstanding or the current state of the economy. If the economy improves and interest rates fall, you may sell further bonds until the rate reaches 9% again.

Bond rates are lower in the Western USA due to government subsidies.

To sell bonds or buy them back, call your broker.

Interest Rate Table

Economic Climate	INTEREST RATES Number Of Bonds Outstanding 0	1	2	3	4	5	6	7
Boom	2%	3%	4%	5%	6%	7%	8%	X
Moderation	3%	4%	5%	6%	7%	8%	X	X
Normal	4%	5%	6%	7%	8%	X	X	X
Recession	5%	6%	7%	8%	X	X	X	X
Panic	6%	7%	8%	X	X	X	X	X

Notes: Interest rate percentages are the rate you will pay another bond, depending on the current economic climate and the number of bonds you have outstanding. X= no bond sales possible.

Calling Your Broker

To conduct most financial transactions involving stocks and bonds, you call your broker to get access to the financial activity menus. Pull down the Action menu and choose the option "Call Broker". This opens the Financial Summaries window. From here you can obtain certain financial information about your railroad and your competitors, sell or buy back bonds, buy and sell treasury stock, buy and sell competing railroad stock (Stock Market Takeovers, page 111), and operate competing railroads (see Controlling Other Railroads, page 112).

To sell or buy back a bond, pull down the Cash menu. If you choose the option "Sell $500,000 Bond", that amount of money is added to your cash and to the size of your bonds. Choosing the option "Buy Back $500,000 Bond" subtracts that amount from your cash and bonds.

To buy stock in your railroad and put it in your treasury, pull down the Buy Stock menu and choose the option "Buy Treasury Stock". The cost of the stock is subtracted from your cash and 10,000 shares are added to your treasury. Treasury stock is sold in the same manner as it is bought, except from the Sell Stock menu. Note that you cannot buy treasury stock if the public doesn't own any, and that you cannot sell treasury stock if there isn't any in the treasury.

The price of stock is determined by normal buying and selling on the stock market. When a very large order to buy or sell is placed, the price

is forced up or down in order to find enough sellers or buyers on the other side to complete the transaction.

All stock transactions in Railroad Tycoon are extraordinary orders involving relatively large amounts of the outstanding shares. For this reason, expect to actually pay 10% more than the quoted price when buying, and receive 10% less than the quoted price when selling.

Short Term Loans

During play you may spend more money than you have. When you engage in deficit spending, the color of your current cash in the display window changes color. If at the end of a year you have a negative cash position, you are charged 12% on the negative balance.

Declaring Bankruptcy

Like any business, railroads can get so deeply in debt that protection from debtors and court supervised reorganization is the only alternative to utter ruin. The normal result of a bankruptcy is that the previous owners (stockholders) are wiped out, the bonds outstanding are reduced to a manageable level, and the remaining lenders receive new stock in exchange for their money that was lost. If the business returns to health, the rising stock price may someday equal or exceed the money lost when part of the bankrupt company's bonds were converted to stock.

If economic conditions, accidents, and other circumstances work against your railroad to the extent that it appears headed for ruin, you have the option of declaring bankruptcy at any time. This step can partially relieve your debt burden and perhaps get your railroad back on its feet. There may be times when it's good defensive strategy as well.

To declare bankruptcy, call your broker, pull down the Cash menu, and choose the option "Declare Bankruptcy". All bonds that can be repaid from your cash are paid off, half of your outstanding bonds are eliminated (rounded down), all of your treasury stock is eliminated, all of your stock held by competing railroads is eliminated, and the public is left with 100,000 shares.

After declaring bankruptcy, you may not lay any more track until your cash balance is positive and all remaining bonds have been repaid.

FINANCIAL REPORTS

As your game of Railroad Tycoon continues you may call up a number of different financial reports to examine the progress of your railroad. The reports that are available are a Balance Sheet, an Income Report, a Train Income Report, and a Stock Price Graph. All of these reports are available during play. From any display, pull down the Reports menu and choose from the list the report you wish to see.

Balance Sheet

The Balance Sheet compares the value of the assets and liabilities of your railroad and shows whether you have made a profit or loss during its existence. The figures are presented in two columns, the right hand side for the year to date, and the left hand side for the lifetime total of the railroad up to this moment.

Balance Sheet

Lifetime

Year to Date Changes

BALANCE SHEET: 1932
Charlottesville & Richmond RR

Assets:		
Operating Funds:	$ 418,000	$ 130,000
Treasury Stock:	$ 360,000	$ 90,000
Other RR Stock:	$ 170,000	$ 40,000
Facilities:	$ 100,000	$ 0,000
Industries:	$ 0,000	$ 0,000
Real Estate:	$ 127,000	$ 0,000
Track: 42 miles	$ 126,000	$ 0,000
Rolling stock:	$ 26,000	$ 4,000
	$1,330,000	
Liabilities:		
Outstanding Loans:	$ 500,000	$ 0,000
Stockholders Equity:	$ 500,000	$ 0,000
PROFIT:	$ 300,000	YTD: $ 260,000
Stock Price		

Liabilities, expenditures, or losses are indicated by figures in a specific color on screen (see the Technical Insert), or with a (-) sign in documentation illustrations. Figures in normal color indicate income gains, positive value of assets, increases in value of assets, and profits.

Operating Funds is the cash you now have on hand.

Stock assets are the value of your treasury stock and the stock of other railroads that you own. This value is a liquidation value, or what you could expect to get for it if you tried to sell it all right now. Because each buy or sell order tends to raise or reduce the price by 10%, the listed value is substantially lower than just the number of shares you own times the current price.

Facilities include all of your stations, signal towers, and station improvements, valued at their purchase cost.

Industries include any steel mills, factories, or other industrial sites that your railroad has purchased, also valued at purchase cost.

Real estate is the value of the right-of-way that you have purchased when laying track, and does not include buildings which are listed under facilities.

Track is the value of track you have laid, listed at what it would cost if laid during a Normal economic climate.

Rolling stock is the value of locomotives and cars you own at their purchase cost.

Note that most assets are valued at what they cost. For example, in the illustration above the C&R railroad has purchased 3 stations for $100,000 each, and they are listed as assets under Facilities as worth $300,000 in total. Real estate is an exception, in that it generally increases in value. Stock, both treasury and in other railroads, can fluctuate in value.

In the year to date column is shown any changes in the value of assets during the ongoing fiscal period. The statement above shows that so far this period $132,000 in cash has been generated, treasury stock has increased in value by $90,000 and other railroad stock owned has increased by $40,000. A negative number appears in the rolling stock row for the current year if you eliminate cars from your trains, or replace or retire locomotives.

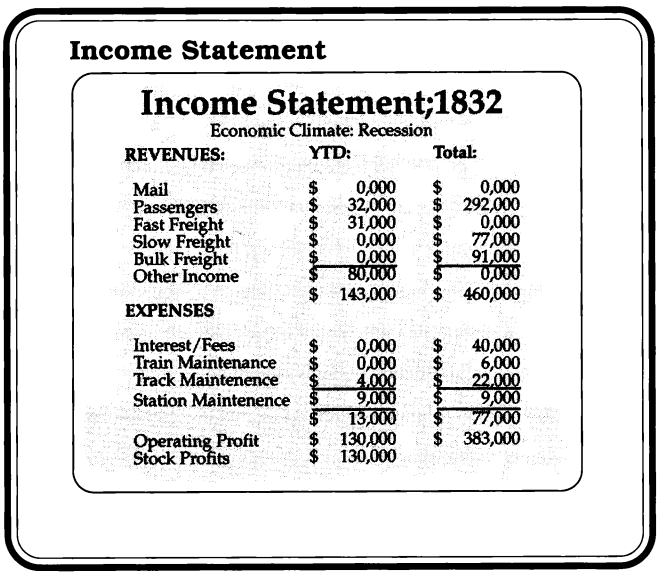
The asset total for the railroad is the value at this moment of everything the railroad owns.

The liabilities of your railroad are the bonds which you have outstanding and the stockholder's equity, the money they paid into your company to buy stock when it was started. In accounting terms, the long term profit of your railroad, the money that it has earned, is the value of your assets minus what you owe bondholders (debts) and stockholders (equity). This profit figure is also known as retained earnings, or profits above investment and debts that have been plowed back into the company.

In the case of the C&R railroad, it has assets of $1,330,000 versus equity and bonds of $1,000,000. It has made a profit of $330,000 in its operating lifetime.

Income Statement

The income statement reports earnings and expenses for the current fiscal period and for the lifetime of the railroad. The left hand column reports year to date (YTD) figures and the right hand column the lifetime total. The figures in the total column do not include the YTD figures in the left hand column. Revenue shows sources of income and expenses show where cash has been spent. The operating profit (or loss) is the money earned (or lost) in either time frame, calculated by subtracting expenses from revenue. Stock Profits indicates the gain or loss, so far this year, in the value of stock you own.

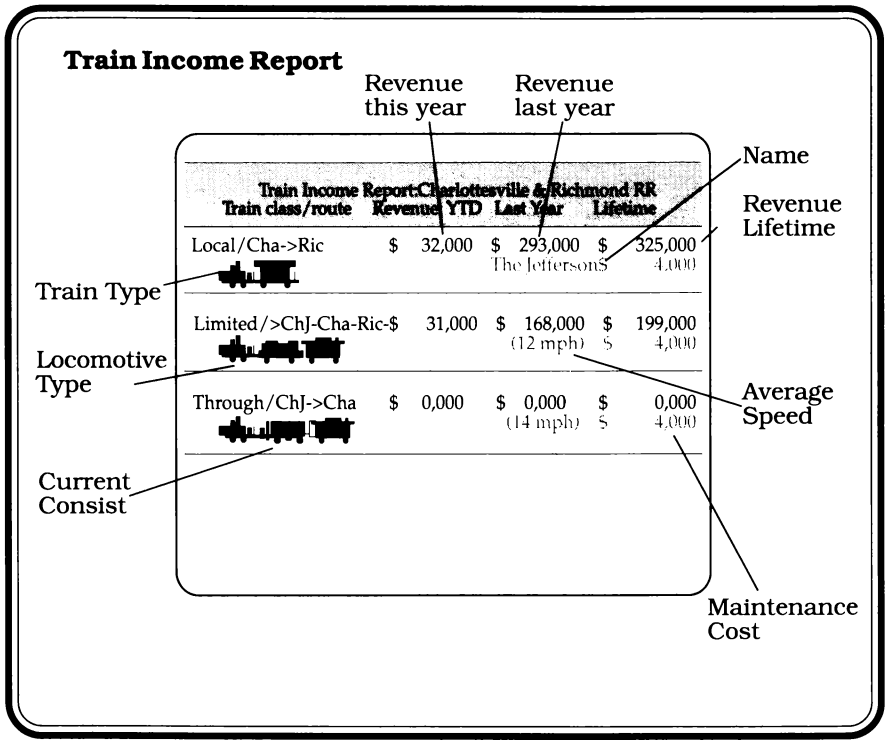


The revenue for the freight classes, such as mail, passengers, etc., is the income earned for delivery of that type of cargo. For example, in the statement above, the C&R has earned $32,000 so far this year, and $292,000 in its history prior to this year, for delivery of passengers. Other Income is earned for delivering Priority Shipments and by restaurants and hotels your railroad owns in stations where passengers are delivered.

Under expenses, Interest/Fees is the money you have paid out in interest on bonds, interest on negative spending (spending money when your cash balance in $0 or less), and fees paid for selling or buying back a bond. Train, Track, and Station Maintenance are expenses you must pay for salaries and upkeep of these items.

Train Income Report

From this report you can read at a glance how each of your trains is performing. The most important information is normally what the train has earned so far this year (YTD), what it earned last year (Last Year), and what its expected maintenance cost is for this year. The Train Class shows whether the train is a local, through, express, or limited. Under route is shown the stops the train is scheduled to make



and a > indicator shows its next destination.

Also shown is the train's name if it has one, correct icons for the types of locomotive and cars that make it up, and its average speed.

If you have so many trains operating that they don't fit on one page, press the *Selector 1* to flip to the next page of trains.

Stock Price Graph

This graph displays the relative prices of your own stock and the stock of the competing railroads. Across the top of the graph are the names of the railroads that have stock outstanding. Starting in the bottom left corner are colored lines that trace the changes in stock prices as the game continues.

The lines on the graph are color coded with the names of the railroads above. Trace from the right-most end of any line to the left side of the graph to get an approximation of the current value of that stock. For example, the line with the same color as the C&R's name ends just short of of the $20 line, indicating a price of around $18 per share.

When a stock's price reaches or goes over $100 per share, the stock splits. Two new shares are issued for each one old share, and the price of the new shares is set at half the price of the old share. The scale of prices on the graph changes to reflect the splitting of a stock.

The scale of the graph on the left side extends from $0 to $100 when a game begins. After a stock split the scale doubles so that it always can show the correct price of stocks. For example, the first time a stock splits, the scale changes from $0 - $100 to $0 - $200. In this way the correct relationship between the prices of split and unsplit stocks is maintained.

Economic Climate

The economic climate in Railroad Tycoon moves between Panic, Recession, Normal, Moderation, and Boom. Panic is the worst, and Boom is the best. The overall trend is a gradual movement toward better times, but sudden bad news can drop the economy quickly and far. The current climate affects the interest rate on bonds, the cost of track, the cost of double track, the cost of right-of-way, and the supply of cargos generated. Generally, things cost more and more cargos are generated in better times.

Competing railroads are also affected by the economic climate. They normally have lower revenues in worse times, but may do more building to take advantage of lower costs. They may also roll over their bonds in good times to lower their interest costs.

Changing economic climates offer you opportunity and challenge. The opportunity in good times is to possibly lower your interest costs by buying back high interest bonds and selling new low cost bonds. In bad times construction costs are lower and this can save you money if you can arrange to do your expansion then. Also, bad times may require you to reduce the number of trains or the cars on existing trains. Smaller, faster, full trains in bad times can be expected to make much more money than larger, slower, half empty trains.

ADDITIONAL REPORTS

In addition to Financial Reports, you may call up other reports for information about your railroad. These include a list of your Accomplishments, an Efficiency Report, and a History of your railroad.

These reports are available during play. From any display, pull down the Reports menu and choose from the list the report you wish to see.

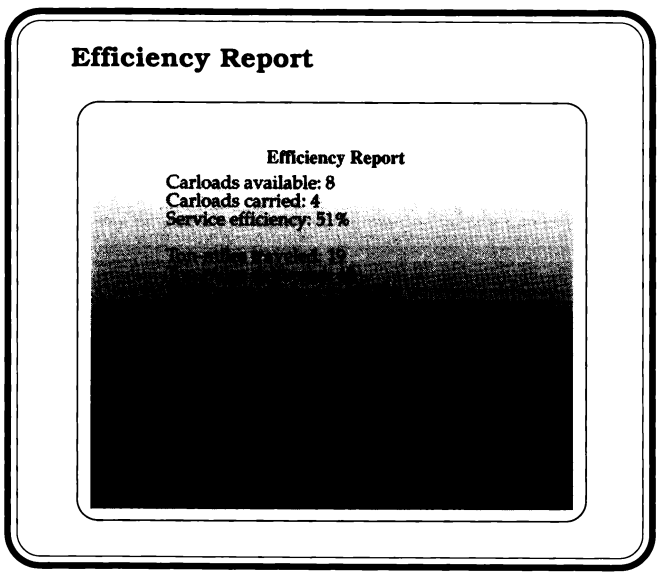
Accomplishments

This report is simply a log of the important events that have taken place on your railroad during your presidency. Generally, any news that is sufficiently important to make it into the newspaper headlines is added to the list of your accomplishments. Examples of accomplishments are the initiation of service to a new city and new records set for earnings.

Efficiency Report

This report supplies information on how well your railroad is doing in taking advantage of opportunities to pick up cargos supplied along your system.

The first part shows the total number of carloads of cargo that have been made available so far this fiscal period and during the previous period, and how many you managed to pick up. The percentage number indicates approximately how much of the available cargos you carried. The closer the percentage approaches 100, the more efficient your railroad is at taking advantage of profit opportunities.



Ton-miles traveled is a measure of the capacity that you have moved. For example, a 40 ton car that travels 10 miles equals 400 ton-miles traveled. Ton-miles delivered is the number of tons delivered times the distance those tons were carried. If the 40 ton car is fully loaded when it traveled 10 miles and then delivered, it would equal 400 ton-miles delivered.

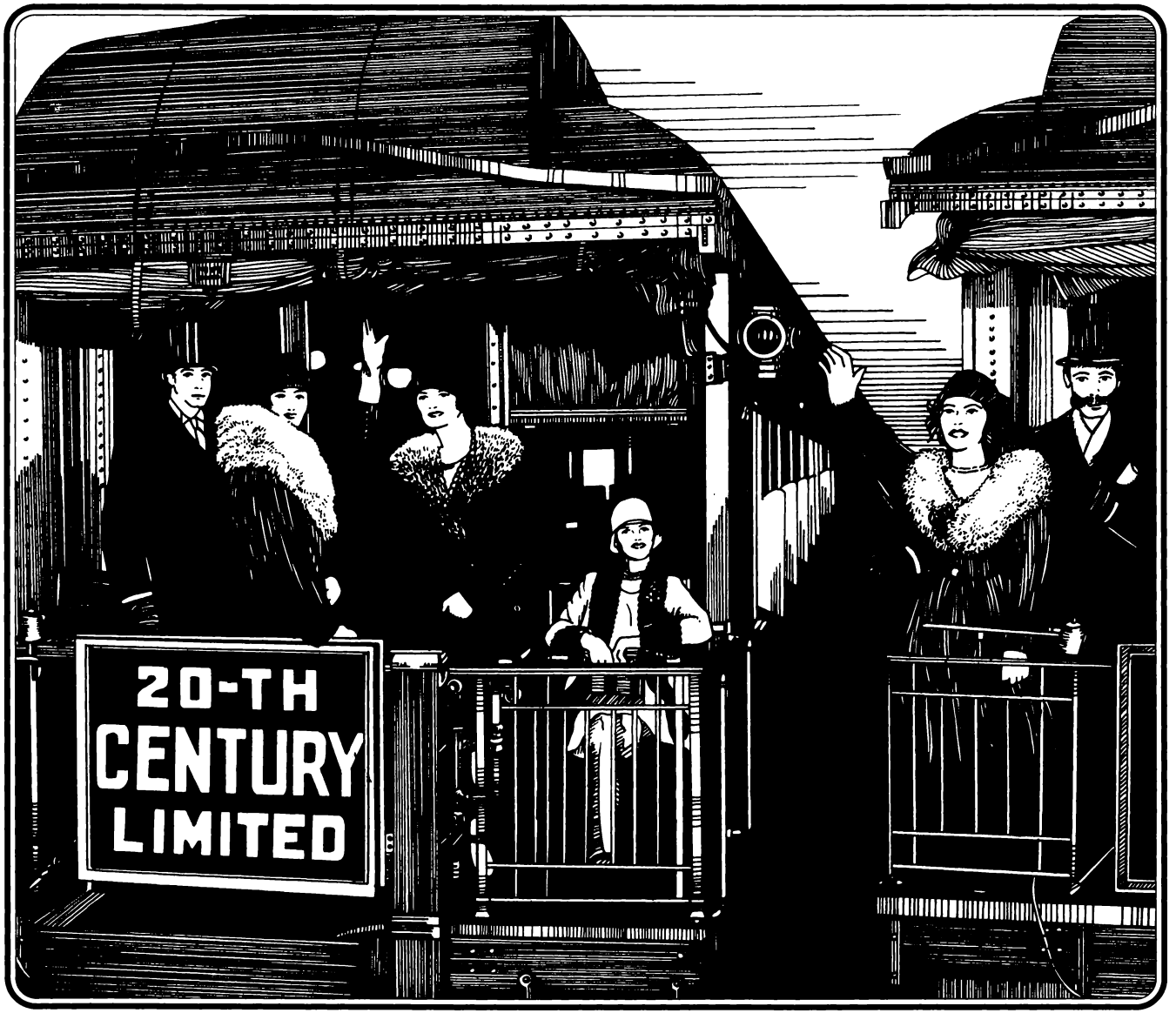
The utilization efficiency is ton-miles traveled by your railroad divided into ton-miles delivered. It roughly tells you the percentage of time your cars are traveling empty.

Revenue efficiency measures the money you make versus the number of ton-miles you carry. The dollar figure is an estimate of the money you earn per ton delivered. The higher the number, the more money you are making per ton, and the more efficient are your operations.

History

The history report is a replay of your railroad's accomplishments reviewed on the Regional Display that shows the growth of your railroad, the economy, and your competitors, up until now.

The replay is carried out on a year by year basis.


20-TH
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5 RAILROAD COMPETITION

COMPETING RAILROADS

Once the technology of trains on rails was demonstrated to be practical, railroads began appearing throughout the industrial world. The earliest roads had large areas all to their own, but that circumstance didn't last. As more entrepreneurs and investors were dazzled by the glamor and apparent riches of railroading, the countrysides became crisscrossed with new tracks.

Rival railroads fought for access to new or already lucrative areas. When in direct competition, healthier roads cut rates hoping weaker opponents could not afford the losses. The ultimate competition came in the stock market where rivals fought for control of each other's companies or other railroad pawns on the map.

The people who ran railroads during the era of expansion were of all types, brilliant engineers, accomplished executives, shrewd financiers, incompetents, and crooks. Railroad presidents not only had to manage their own business, but understand the strengths and weaknesses of their rivals and plan accordingly.

In Railroad Tycoon you too have rival railroads to contend with. Watch out for competing railroads expanding and cutting you off, starting rate wars at key stations, or attempting to take control of your railroad in the stock market. In return, look for opportunities to cripple or take over your competitors. Getting control of one or more of your rivals may significantly improve the success of your railroad.

Up to three of your rivals may start up their own railroads. These railroads are run according to the personality of the historic figure that is their president. For example, a railroad run by Jim Hill is always looking for new cities to build to. Roads run by J. P. Morgan or Jay Gould are adept at stock market dealings.

You may not lay track across the track of a competing railroad, and you may not build a station within 5 squares of a competing railroad's station. You may lay track directly into a rival's station, triggering a rate war (see Rate Wars, page 109).

Once competing railroads are started, you may buy and sell their stock in a manner similar to that for buying your own stock (see Calling Your Broker, page 97). If you can purchase enough of a competitor's stock, you take the railroad over (see Stock Market Takeovers, page 111) and can partially control it (see Controlling Other Railroads, page 112).

RATE WARS

Prior to government regulation of freight rates, a standard tactic of rival railroads serving the same cities was to cut rates. This drew business away from competitors, weakening them and hopefully driving them from the vicinity. The survivor could then raise prices to very profitable levels without the competitive pressure keeping them down.

Your railroad may be the target of a rate war attack from a competing railroad, or you may use the rate war as a means of weakening a rival. To win a rate war you must understand what is going on and how best to proceed.

A rate war is triggered when you either build track into a competitor's station or a competing railroad lays track into one of your stations. You receive a message announcing that a rate war has started, and the border around the Shipping Report of the affected station turns to the color signifying half rates. Until the rate war is concluded, the border remains in the half rate color, signifying that all revenues for delivering cargo here are halved. A cargo that would normally earn $20,000 when delivered, earns $10,000 when taken to a station in a rate war.

The winner of a rate war is decided by the local city council of the town where the war is underway. At the end of each fiscal period the council examines the service provided by the opponents and votes for which should be given a monopoly on service to the city. Beginning with the vote after the second fiscal period of the war, the first railroad to gain at least a 66% vote majority is declared the winner.

The votes in a rate war are directly tied to the amount of cargos delivered to, and taken from, the contested station. For example, if the station demands coal, the more coal you can deliver there, the more votes in your favor. If the contested station has a large supply of wood, your vote total increases for every ton of wood carried away. The city council is affected by your record on every cargo that they supply and demand, so it is in your interest to devote special trains to servicing this station, regardless of revenue, just to earn votes.

If a competing railroad loses a rate war, all of its track leading out of the station is torn up. If this leaves any stations isolated with no other track connections, then those stations are also eliminated

If your railroad loses, all of your facilities, track, trains, bridges, etc., within three squares of the station are eliminated. You receive no compensation for these losses.

If you win a rate war, the station becomes wholly yours. The border around the Shipping Report for the station turns from the color signifying half rates, to the color signifying double rates. For the next fiscal period all cargo delivery revenues are twice the normal rate. Having shamelessly acceded to the town's every wish to win the rate war, you are now in the happy position of giving them a lesson in monopoly economics.

You may not build facilities such as engine shops, post offices, etc., at a station in a rate war.

Stock Market Takeovers

In the latter half of the 19th Century, many of the greatest railroad battles in America were fought on Wall Street, far from the tracks and trains of the combatants. One way to neutralize a competitor was to take him over and make his resources work for you, not against you. Some of the more infamous railroad men of this period knew next to nothing about running a railroad, but were experts in stock manipulation.

While building and operating your railroad, you must remain aware of the stock market dealings of your competitors. Given the opportunity, they may take over your company, loot it of cash, and put you out of work. You must protect yourself from that risk, and also look for opportunities of your own. It is possible for you to take over one or all of your competitors, and have them work for you thereafter.

In addition to buying your own stock, you may purchase stock in any competing railroads. If at any time you hold over 50% of the stock outstanding (owned by the public, in the company treasury, or in your hands), you take it over and control it (see Controlling Other Railroads, page 112).

Stock purchases and sales are made in a manner similar to those for your own stock (see Calling Your Broker, page 97). However, if the opposing management has bought the remaining stock you need and put it in the treasury, you can only buy the remaining shares by making a tender offer.

Once the public has no shares left to sell, you may tender an offer for all of the shares you don't own. To do this call your broker from the Action menu and attempt to buy more stock in the target railroad. A new menu appears informing you that you must tender for all the remaining stock in the treasury at twice the current market price. You have the option of making this purchase or not.

If you proceed to tender for the remaining stock, the cost is subtracted from your cash and you then own 100% of the stock in the railroad.

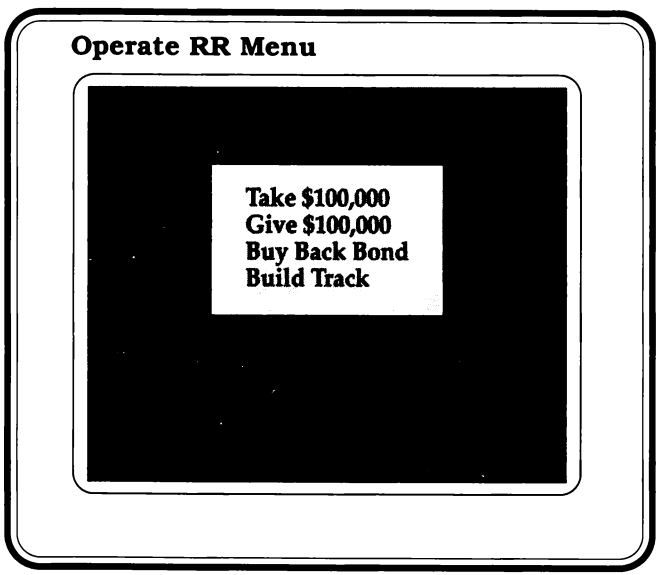
Note that since you only need over 50% to retain control, you may sell off some of the stock now or later without losing control. However, if you sell stock to the point that you no longer own over 50% , you lose control of the railroad and it becomes a competitor again.

Controlling Other Railroads

Controlling one or more of your competing railroads can help you financially and tactically. The value of their stock can increase, helping to increase the value of your own. You can transfer money from their treasuries to yours, or vice versa. You can attempt to have a controlled railroad build track that blocks other railroads from expanding, while your own railroad grows unhindered.

Having obtained control of a rival you must decide how best to profit from its resources. Is the best course to invest in it, or have it invest in you? Use it as a blocker, or build it away from you to keep your options open? Have it start a rate war against another rival?

Once you have taken control of a competing railroad, you may make some operating decisions for it. To operate a controlled railroad, pull down the Action menu, choose "Call Your Broker", and then pull down the Operate RR menu. You have four operating choices, as shown in the Operate RR menu below.



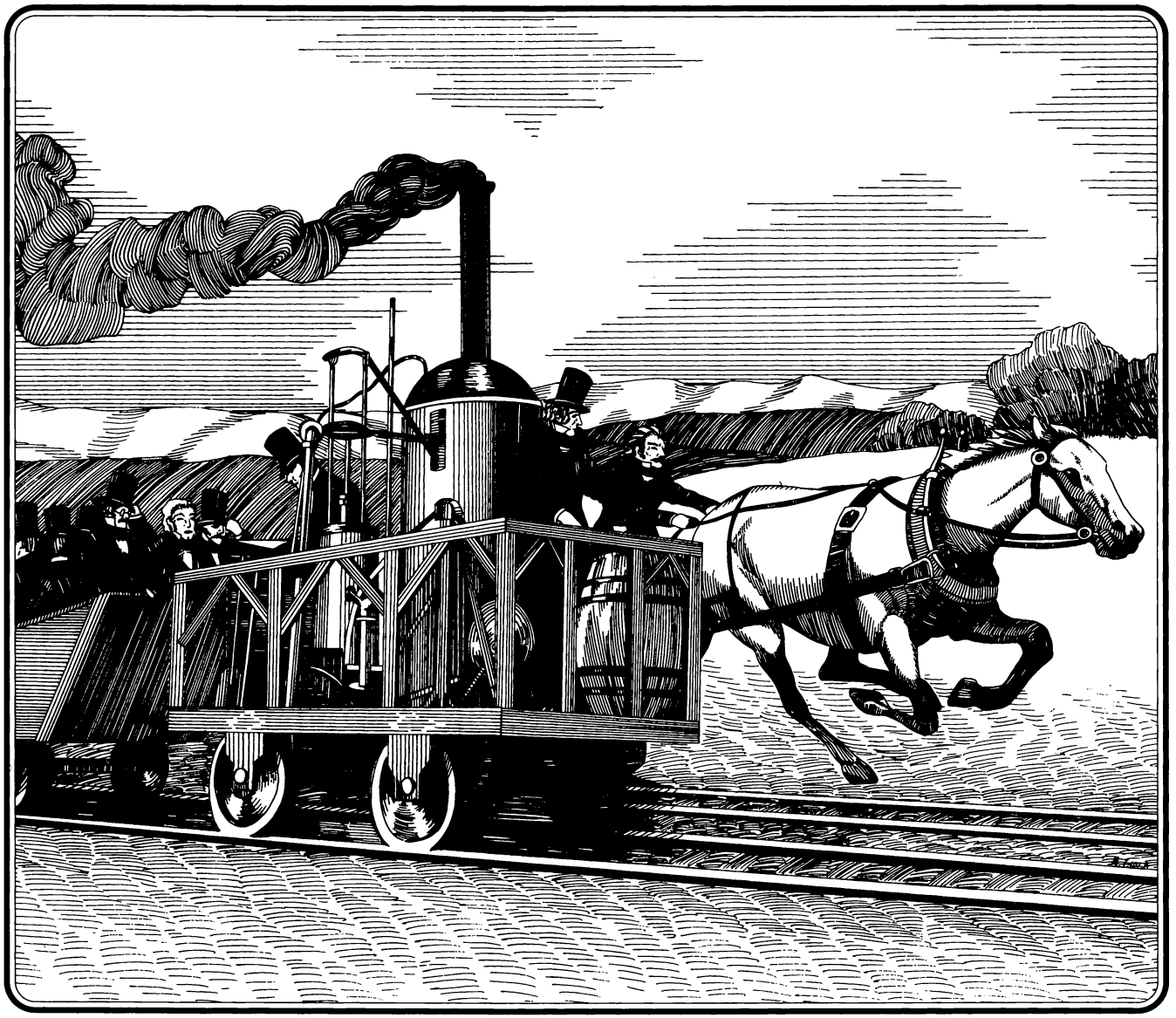
Choose the "Take $100,000" and "Give $100,000" options to move money from the controlled railroad's treasury to your railroad's treasury, or vice versa. Money is normally moved in $100,000 amounts. Money may also be moved in $250,000 increments if a substantially large amount of cash is available in either treasury, and the Operate RR menu changes to reflect this ability.

Choose the "Buy Back Bond" option to order the controlled railroad to buy back one $500,000 bond. The railroad's cash and bonds are then reduced by $500,000. Controlled railroads only buy back bonds when you tell them to do so. They may never sell more bonds.

Choose the "Build Track" option to order the controlled railroad to attempt to connect to a certain city. A text window opens giving you the opportunity to name the cities you wish it to build from and to. Type in the name of the city and press the *Selector 1* key. Thereafter, the railroad attempts to build to the city you named. If it is unable to build there for some reason, a message appears telling you this.

Once you have taken control of a railroad, your exercising of this option is the only way the controlled railroad continues to build.

You may build your tracks into the stations of a controlled railroad, creating Union stations. When this occurs, you automatically build a terminal (normal cost $200,000) for the cost of a station ($100,000). You may build facilities at Union stations.



6
THE RAILROAD STORY

THE ORIGINS OF RAILROADING

The history of railroading can be traced back to rut roads in ancient Greek cities that are thought to have guided ceremonial carts. But the elements of railroading as we think of it all came together for the first time in 1825 when George Stephenson piloted his engine Locomotion No. 1 along the tracks of the Stockton & Darlington Railroad, pulling a train of 34 cars.

Preserved from that day is an account of the somewhat mystical beginnings of railroading from one of Stephenson's workmen. Having unloaded the locomotive from its wagon, mounted it on the tracks, and filled its boiler with water, the men discovered they had no match. While one man went off to get a lantern, Robert Metcalf used sunlight through his magnifying glass to light his pipe. Being practical he turned his glass on some hemp packing and soon had transformed the power of the sun into the fire of the first locomotive to pull a common carrier train.

That day in September was a triumph not only for Stephenson and the founders of the railroad, but for all the other inventors and thinkers who had contributed to the new technologies and ideas brought together there for the first time. The combination of track, locomotive, and common carrier train, was to revolutionize the transportation of people and goods, and help change the world forever.

The first component of the railroad to be developed was the track that guided the trains and cars. The benefits of moving wheeled vehicles along rails of some sort had been recognized for many years prior to 1825.

By distributing the weight of the load along the rail and down through the track structure, very heavy loads could be supported.

Without this weight distribution, the heavy steam locomotives that were soon to appear would be unable to move without sinking into the ground.

A smooth wood or iron rail surface in contact with the smooth wheels of moving vehicles offered much lower resistance, or friction, than the uneven roads or ground. Flanged wheels on the vehicles helped them adhere to the rail. The combination of rail and flanged wheel meant that heavy loads could be pulled by horses, and then steam locomotives, at unprecedented speeds.

Rails served as guides, allowing a single power source to pull a long string of carrying vehicles and thereby spread the costs of power over more loads. Prior to rails, vehicles had to be moved singly, each with a single power source, usually a horse.

Track was used prior to the 1820's primarily inside and outside of mines where the expense of its construction was practical due to the frequent movement of heavy loads. Other than for mines, tracks were rarely seen until tramroads appeared in the 1600's. Tramroads were tracks over which horses pulled specially wheeled wagons. Before tramroads became widespread, however, a new power source had appeared, the steam locomotive.

The first practical demonstration of a steam locomotive occurred in 1804 when Richard Trevithick's engine pulled some ore cars along a tramroad in Wales. This early design did not generate the enthusiasm it deserved, but other inventors continued to search for efficient ways to transform high pressure steam into a locomotive power.

The success of Stephenson's Stockton & Darlington designs, plus his later triumph at the Rainhill Trials of the Liverpool & Manchester, got the Western world's attention. Men of industry and science came from all over to see steam locomotive power first hand. Most went home impressed with the new technology and many drew up plans for railroads in their communities.

The difference between the Stockton & Darlington and previous railroad experiments was that the train that Stephenson pulled was a common carrier. Anyone wishing to travel or ship goods could buy space on the train. The freight and passenger cars were owned by the company, and they promised to have the train depart from a depot at

one end of the line and arrive on a schedule at another depot where passengers and goods unloaded. The Stockton & Darlington was the model for all future railroads.

Railroads would have been only interesting toys if there were no opportunities for their profitable employment. By the 1820's England had witnessed the economic value and profitability of canal transport. The new technology of railroads promised even greater practicality and profits than canals because it offered greater speed and capacity, was cheaper to build, could be built anywhere, and could operate in any weather.

The Role Of Railroads

Introduction

The role of a railroad is to assemble and move trains of cars carrying goods and/or passengers from one place to another. Because they can move large loads over long distances for minimal costs, they are often by far the most efficient method of transportation available. Today in North America, mainline railroads principally carry freight. Passenger traffic is mainly concentrated in commuter traffic into and out of major cities, carried by local private or government owned lines. In most European countries, railroads still have important passenger business.

Historically, the role of railroads has gone through many changes. Beginning as a special type of transportation with limited use, they expanded into the principal way of moving anything, anywhere. Their role in the economy has shrunk in scope today, but not in importance.

Changes Over time

Prior to the Stockton & Darlington, railroads were adjuncts to the mining business. Only the steady volume and weight of mine traffic justified the expense of tracks, power, and cars. The typical train consisted of a horse or primitive locomotive pulling a few cars of coal or ore.

The main cargo of the first Stockton & Darlington common carrier train was still coal, but the difference was that flour and passengers were also carried along. The railroad advertised that it was offering transport service to and from its terminal cities. Freight could be shipped by the package or the carload, and passengers were welcome. All the cars in the trains were owned by the company and arrangements were made with the railroad for loading and unloading. From this beginning of common carriage, the role of the railroad began to broaden and diversify.

The first common carriage railroads were built to connect coastal cities with sources of raw materials in the interior. For example, the Stockton & Darlington, the Liverpool & Manchester, and the Baltimore & Ohio were all planned originally to increase the flow of trade to ports. This traffic did indeed flourish, and these early roads found to their delight that traffic going back to the interior grew as well. Very quickly passenger traffic in both directions far exceeded expectations, and railroads developed the concept of trains wholly dedicated to carrying passengers.

The success of the first railroads inspired imitators, and soon railroads were being built everywhere. Every city and then every town wanted to be connected to its neighbors by rails. People and goods began moving back and forth by train in astonishing amounts. Access to railroads brought new industries and population into a region, increasing traffic even more. Dedicated railroads were built to serve individual industries such as coal mines and lumber mills.

The cheap, fast, and safe transportation provided by railroads was an added spur to the economic growth of nations undergoing the Industrial Revolution. Railroads themselves benefitted from improved technology as steel rails and more powerful locomotives provided more efficient service.

The peak of railroad mileage in the United States came in 1916. At this time most intercity transportation within the country was handled by railroads. Raw materials, finished products, livestock, and people moved throughout the country almost entirely by rail.

Railroads Today

Since 1916 the mileage of track in the United States has decreased nearly 25%, but surprisingly, the ton/miles of traffic carried has more than doubled. These changes were brought about mainly by the abandoning of parallel and branch tracks, and the consolidation of traffic. During the heady days of railway expansion many routes were overbuilt and the traffic could not support all the railroads trying to compete. Inefficient lines have now been mostly eliminated.

When railroads hauled most of the passengers and freight for the nation, branches and spurs trailed off the mainlines in every direction, serving even the smallest industry or community. Today the branch line is all but gone from *Class 1* railroads ($50,000,000 gross revenue per year), though many are being operated by local companies or governments. The major railroads have trimmed down to just their mainline trunks.

Traffic is now concentrated at major freight terminals and large consolidated freight trains constitute the majority of traffic. As more of the transport roles that trains once provided have gone to other carriers, railroads have concentrated their business where they are most efficient. When freight can be quickly loaded into and dispersed

from the large, fast, long distance trains that operate today, the costs of railroad shipping cannot be beat.

The single most common railroad cargo today is coal carried to power generating plants, metallurgical industries, and ports for overseas shipment. Additional common cargos are containers or truck trailers on flat cars, iron and steel scrap, metallic ores, coke (the kind made from coal and burned to make steel), petroleum products, fabricated metals and machinery.

When railroads became viable they quickly superseded canals, stagecoaches, and freight wagons as the principle method of ground transportation. For over 100 years they remained dominant. In the 20th Century many of their roles have been passed over to other transportation modes, such as automobiles, trucks, airplanes, barges, and pipelines, but they remain extremely efficient in their core business.

Railroads can be expected to have an important role in transportation for a long time, and in the future may find several of their previous roles restored.

RAILROAD FINANCES
Railroad Stock

Railroads were some of the first great capitalized corporations. The expense of their construction could not be born by one man or a small group, especially when so much work had to be finished before the first train could run. For this reason, most railroads were originally financed by stock subscriptions.

The new corporation began with a charter from the government, usually the state in the United States. According to this charter, so many shares of stock were authorized for sale, each share equalling a part ownership in the company. These shares were then offered to the public for purchase, thereby raising funds.

In the Baltimore & Ohio's case, shares were offered at a price of $100 each, but you subscribed to the shares by putting up only a percentage of the cost, say $5. At regular intervals stock subscribers were expected to make additional payments until the entire $100 had been paid in. If you missed your payments, the ownership of the stock normally reverted to the company and your investment to date was lost.

In return for your investment the company promised to begin paying dividends at a future date from the revenue it expected to be earning by that time.

The great advantage of funds raised from stock sales was that there was no requirement that they be paid back. Investors were gambling that the railroad would be profitable, returning to them dividends and perhaps even an increase in the value of their shares. But if the railroad did poorly, their only recourse was to remove the president and bring in someone who could try to set things right.

In addition to stock sales to the public, local or state governments would occasionally purchase stock to help finance a railroad enterprise thought to be especially beneficial to the community. A town might offer to buy stock to encourage a railroad to build into the area. For example, the Baltimore & Ohio built a line from Baltimore to Washington, D.C. at the request of the state of Maryland in return for the state buying a large block of B & O stock and other considerations.

Railroad Bonds

When stock sales dried up, the next alternative for raising money was to borrow it. This was most often done by authorizing and selling bonds to the public. The railroad agreed to buy back the bond at a fixed date in the future, and pay a fixed amount of interest each year to the purchaser. For example, if a 30-year 5% bond was sold for $1000, the railroad would receive $1000 today, pay $50 interest each year to the bond buyer, and after 30 years buy back the bond for $1000.

The bond buyer was betting that the railroad would not fail, giving him a fixed return of $50 each year, and then returning his $1000. The railroad was betting that it could put the $1000 to work immediately in such a manner so as to generate enough future income to cover the interest payments and pay back the $1000 in 30 years.

The bond holder owned only the bond, he had no part of the railroad's ownership. However, if the railroad could not buy back the bond after 30 years, the bond holder normally had first right to any money raised from the sale of bankrupt railroad assets.

Railroads tried very hard to keep bond holders happy and paid up, however, because the interest rates they had to pay and their ability to sell more bonds depended greatly on their previous record of payment.

Land Grants

The railroads in North America were often built into areas of low population where traffic was expected to be light for some time. Especially in the West where transcontinental railroads were thought to have important national benefits, the government subsidized railroad construction by giving the railroads large blocks of land. The railroads sold this land to raise money for construction.

This system served very well, and by the late 1800's the western expanse was bridged several times. The land was sold to farmers and entrepreneurs who built new towns along the roads, accelerating settlement and soon generating rail traffic. However, the system was not regulated and many of the land grant railroads were rife with corruption and swindle.

The most famous western fraud was the Credit Mobilier scandal involving the Union Pacific Railroad. The directors of the Union Pacific started a second company, the Credit Mobilier, and hired it (and

themselves) to do the construction of the Union Pacific. They then proceeded to bill themselves about three times the cost of construction, pocketing the difference. By the time the Union Pacific completed its famous link with the Central Pacific, it was essentially bankrupt.

Despite the scandals, stock and bond holder losses, and the large government give-away of land, the construction of the transcontinental railroads was considered a good investment for the nation. When the looted railroads were reorganized they generally proved to be good investments beyond their strategic value.

It should be mentioned that one transcontinental road, the Great Northern, was built from Duluth, Minnesota to Seattle, Washington, entirely without government land grants. The Great Northern was the creation of James Hill, tough and often ruthless, but one of the great railroad builders of the age.

Stock Market Shenanigans

Unfortunately for many investors and bondholders, railroads and their stocks often became playthings in the hands of shrewd and skillful crooks. The result too often was a sudden railroad bankruptcy and financial ruin for investors.

When the stock market worked as planned, the price of a stock at any one time was thought to be an accurate representation of the value of the company. But on Wall Street in the late 1800's, the stock market often behaved oddly, manipulated legally (for that age) and illegally.

That time period was one of consolidation and competition in the railroad business, as overbuilding of railroads was reducing profits. Railroads looked to take over competitors or ruin them financially as a cheap alternative to lengthy rate wars. In this environment men such as Jay Gould, Jim Fisk, and Daniel Drew found opportunity.

The most common ploy was to quietly accumulate a low-priced stock with little prospects, and then generate a lot of buying in it with rumors. Since it was relatively easy to borrow funds against stock values, rising prices generated more buying power that forced prices higher, and so on. At some point the original plotters jumped out, selling their accumulation at a profit, while the late comers watched their hot stock collapse.

A more subtle strategy was the *bear raid*. A little judicious stock buying and the spread of some rumors in the right places were designed to get a stock's price flying upward. At the right moment the bears started *selling short*, or selling shares they didn't have at today's price, in the hope that they could buy them at a much lower price later, just before they were to be delivered. Their short sales helped drive down the stock, plus new rumors were designed to start panic selling. The raiders pocketed the difference between the price they sold at, and the lower price they paid later for the stock they delivered.

For example, assume the raiders decide to attack the Erie's stock, a favorite target, now selling for $50. They begin buying the stock and spreading rumors that the New York Central is buying Erie. The stock begins to climb toward $80. The raiders jump in, selling Erie short at $80, or selling it but not having to deliver the stock for a week. They continue selling and spreading more rumors that the New York Central is not only not buying but planning a new rate war. The Erie stock plunges to $20 in 4 days. The bears buy back at $20, delivering the stock to the people who bought it from them at $80, and pocket $60 per share.

If possible the two ploys were worked together, making money on both the way up and down.

The danger in a bear raid was the risk that the stock you were shorting continued to rise in price, instead of fall, forcing you eventually to pay a higher price than you had already sold it for. If you sold short at $80 and the price rose to $100 before you could buy it back, you lost $20 per share.

In one memorable case, Commodore Vanderbilt got wind of a bear raid on one of his stocks, and started furious buying. The short selling bears, led by Daniel Drew, were caught in a *bear trap*, as the price kept rising further above the price where they had sold it. Drew and his accomplices had to make a secret deal with Vanderbilt on his terms to avoid total ruin.

Jay Gould and others took these games one step further by actually taking control of the Erie and other railroads and manipulating their stock prices from inside. The public may have been bewil-

dered by the violent swings in the stock price of the Erie, but Gould and his friends were making money with each move.

Several years later, the moribund Union Pacific, still feeling the effects of the Credit Mobilier scandal, fell into Jay Gould's hands for a very low price. The railroad immediately began paying large and steady dividends, and the stock price rose accordingly. When Gould sold out for many times his cost, the new owners discovered massive hidden loans that couldn't be repaid and the road went back into bankruptcy.

By the turn of the 20th Century, new regulations on Wall Street had curtailed many of the manipulators' frauds. The Security and Exchange Commission and other government bodies were set up to protect industry and stockholder rights. Most of the villains of this age were brought down by either the government or their own excesses. Jay Gould eluded his enemies to the end, dying rich, but despised.

CONSTRUCTING RAILROADS

Where To Build

The first step in constructing a railroad was obtaining a charter from the government (state or national). This empowered the railroad to build its connections by obtaining passage through private land with the government's right of eminent domain. Having decided that the proposed railroad would sufficiently benefit the community, the government made it possible for the railroad to obtain reasonable passage.

Armed with its charter, the railroad sent its surveying parties into the field to search for the best route. The surveyors had to keep several factors in mind including changes in elevation, curves, the value of the land the road was to pass over, and the proximity of possible revenue sources. The two main concerns were to minimize grades and curves.

A locomotive pulling a heavy train uphill has to devote increasing power to lifting as the grade, or percentage change in elevation, increases. A 3,000 horsepower locomotive pulling a 2,000 ton train (a 1.5 hp per ton train) can travel at 60 miles per hour on level track, but its speed drops to 22 mph on a 1% grade and 10 mph on a 2% grade. Lighter trains are less affected by grades.

Straight tracks are easier to build and maintain, and allow trains to move faster. When a train is moving around a curve, part of the locomotive power is needed to pull the train around, and less is available for pulling forward. Also, the centrifugal force of the curve tends to push the cars out of the curve, putting more drag on the locomotive. In the early days of railroading extremely tight curves restricted the size of engines and cars that could negotiate them.

In 1828 the surveyors of the first Baltimore & Ohio route faced the dilemma of choosing between tighter curves or steeper grades. Drawing on the limited information available from England and having little idea of the abilities of steam locomotives, they minimized grades and accepted exceedingly tight curves. This proved the wrong compromise as locomotives capable of handling grades soon became available. The curved track sections were a constant problem for the railroad, moreover, being rebuilt many times through the years.

When its survey was complete, a railroad had a plan of the track, including where bridges, fills, and tunnels would be needed. Armed with the power of the state, the railroad bought the required land and the construction gangs began building the road.

Track Construction

The earliest track designs in America were modeled on less expensive English examples, including cast iron straps fastened to stone sills laid lengthwise, wood stringers laid lengthwise with iron straps on top, and iron straps on wood stringers laid on stone blocks. The stone construction was satisfactory for horse pulled cars, but absolutely unsuited for locomotives whose weight required give in the track for a smooth ride. Some English roads were built of edged plates laid lengthwise, but these were too expensive for American use.

Where wood crossties had been used instead of stone as a temporary expedient to save time and expense, they were found to actually work quite well. Wood proved to have the necessary resilience and cushioning effect required when steam replaced horses. In addition, track could be spiked directly into the wooden tie.

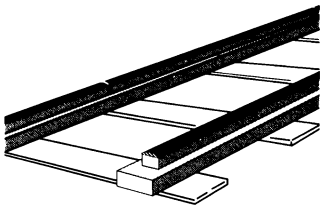
The wooden ties used today weigh 200 pounds. They are pressure treated with 25 pounds of preservative to slow decay. Additional improvements include pre-drilled spike holes that reduce fiber damage and improve spike grip, and metal tie plates that spread the load of the rail over more of the tie to prevent tie cutting and crushing. The expected useful life of first quality ties has been extended to 25 or more years.

In many parts of the world where wood is difficult to obtain, concrete ties have been used instead. The future of concrete ties depends on the length of their useful life, which is still being tested. Concrete ties require a new track structure because the dynamic action occurs between the tie and the ballast, not the tie and the tie plate of wooden tie track.

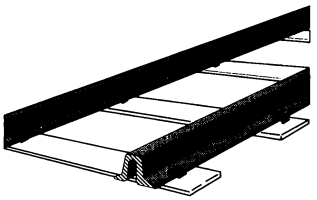
The weight of increasingly heavy locomotives made strap rail dangerous as well as obsolete, because the straps tended to roll with the weight and separate from the roadbed. The disconnected ends, known as "snake heads", had an alarming tendency to pull up and pierce the bottom of cars passing over.

Alternatives to strap and plate rails were bar rails rolled in the shape of an "L", upside down "U", "I", or "T". The flange of the L rail kept the wheels of the cars on the track. The U, I, or T rails laid on wood ties and run over by cars with flanged wheels were found to be the best system. The T rail, laid upside down, proved to have the greatest

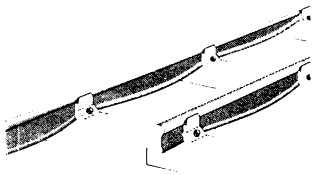
Evolution of Rails



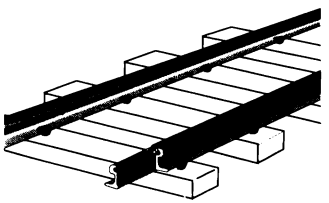
English Wrought Iron, 1811



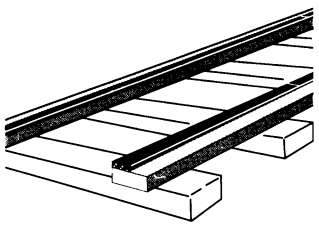
U-Rail, 1844



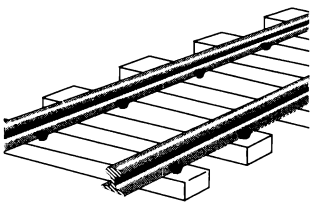
English Plate Metal, 1816



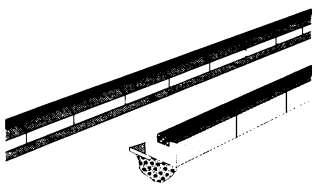
I-Rail, 1848



Strap Rail, 1829



T -Rail, 1850



Stone Stringer, 1830

Alternatives to strap and plate rails were bar rail rolled in the shape of an "L", upside down "U", "I", or "T". The flange of the L rail kept the wheels of the cars on the track. The U, I, or T rails laid on wood ties and run over by cars with flanged wheels were found to be the best system. The T rail, laid upside down, proved to have the greatest strength and is still used today.

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Robert Stevens, the son of early railroad proponent Colonel John Stevens, is credited with designing the T rail on a trip to England in 1830 to study English railroads. During his sea passage he whittled out of wood the first T rail, the familiar rail spike, and the tie plate, all used today in modified form.

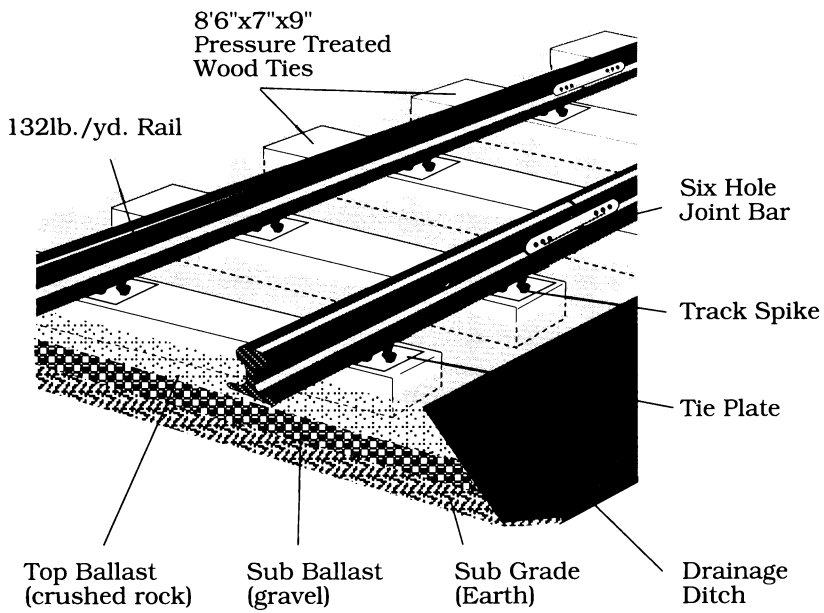
The T design did not become universal, however, until after the development of the Bessemer process reduced the price of steel from $300 per ton to $50. Prior to that cast iron (hard but too brittle) and wrought iron (strong but too soft) had been cheaper alternatives. As a nearly ideal construction material with a useful combination of hardness, strength, and stiffness, steel made the developing power of heavy steam locomotives useable. The iron rail that Stevens ordered in England weighed 15 pounds per yard; current steel rails are rolled out at 112 to 145 pounds per yard.

Rail sections in North America have been 39 feet in length since the 1920's, so as to fit on 40 foot flat cars. The sections are bolted together at the ends. These bolted joints, however, are the weakest part of the track. They

wear out first, and the reduced stiffness at the joint requires extra maintenance to minimize rough riding.

An answer to this problem has been 1500 foot welded rails, made up of shorter rails joined as they are made. These long rails are transported and laid down by a special train, and laid only on high temperature days and with special techniques to minimize contraction and expansion problems. A 1500 foot steel rail would contract 1 foot if the temperature dropped from 100 degrees to 0 degrees without the special steps taken when it is laid down.

Track Structure

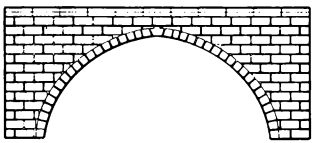


Below the wooden ties to which the track is fixed lies the track ballast, usually consisting of crushed rock. Ballast holds the ties in place, spreads out the load from the rails, and keeps the track structure drained. If the ballast does not drain free of water, ice may put additional stresses into the rail and tie system, and the track may heave when it thaws. Soggy ballast also speeds the rotting of the ties.

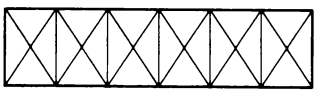
Below the ballast is the subgrade, earth accumulated and tamped down so as to support the track pressure from above in all weather conditions without settling. Drainage ditches are normally dug to the sides of the subgrade to improve drainage. In only a few instance can track be laid directly on the ground without some subgrade preparation.

In his book about modern railroading, John Armstrong describes 4 diesel locomotives linked together rounding a curve at 70 mph being guided and supported by 260 feet of track. Combined, these locomo-

Bridge Types



Masonry Arch



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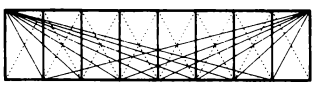
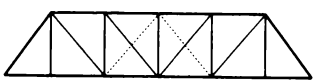


Bollman



Pratt

tives weigh 750 tons. The track below them consists of:

- 11.5 tons of steel rail, held in place by
- 600 lb. of spikes, and resting on
- 3.1 tons of steel tie plates, resting on
- 16.7 tons of crossties, resting in
- 130 tons of crushed rock ballast,

which in turn is resting on the subgrade and right of way below.

Bridges

In 1940 there were nearly 4,000 miles of track in the United States laid on bridges, enough to stretch from New York to London. Bridges were found immediately necessary to cross rivers and other obstacles in the geography because railroads had to minimize the elevation changes on their lines. Preferred construction materials were either stone, wood, or metal, depending on the location, engineering science and technology of the day, and cost.

For the earliest railroads, especially in England, stone was the preferred material for bridge construction. The science of wood bridge building was not advanced, and the early builders were making their best guess as to the future demands on the bridge. These early English structures had great beauty and durability, and the English continued to build in stone when it could be afforded.

The Baltimore & Ohio in America emulated the English, building its first four great bridges and viaducts out of stone as well. But it was soon realized that the expense and time of construction made stone generally impractical in America where the distances covered were so great and the number of bridges needed so large.

Necessity being the mother of invention, American engineers turned to wood as a cheap and fast alternative to stone. Wood was very plentiful in America and often right at hand for the bridge builders. Engineers found that bridge parts could be prefabricated and then brought to the bridge site for installation. In this manner the B&O was able to replace wooden bridges burned by Confederate troops at Harpers Ferry in a matter of days.

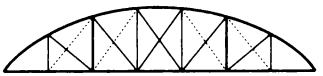
Where stone was not practical, English engineers turned to long iron plate girders laid end to end and supported by stone piers. These were practical in England because of the relative availability of cheap iron versus wood. English railroads as well, were more profitable than American roads of the period and more capital could be raised for permanent structures.

American railroads continued experimenting with wood first, and then iron construction techniques. The result was the truss bridge, first of wood, then wood and iron rods, and then the all iron truss bridge. Trusses linked together in spans could inexpensively bridge a large distance. A major step in the improving science of civil engineering came in 1847 with the publishing of a study analyzing the stresses in truss bridges.

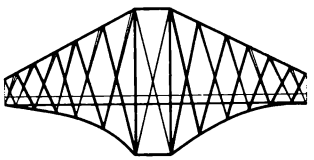
When cheap steel became available, it surpassed all other materials in bridge construction. Its characteristics made it an ideal and economic choice, and opened the way for new designs such as the steel arch, the suspension bridge, and the cantilever. The first all-steel bridge was built of truss spans in 1879 across the Missouri River at Glasgow, Missouri.

Each member, or part, of a railroad bridge must be calculated to support several loads and forces, including the weight of the bridge itself, the weight of the locomotives and cars expected to pass over it, the sideways thrust of swaying vehicles, thrusts generated by trains attempting to stop on the bridge, and side pressures of the winds. As train weight, size, and speed increased, there had to be a corresponding evolution in bridges.

Bridge Types

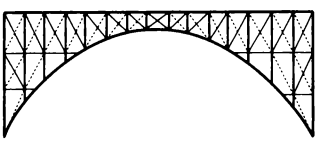


Whipples Browning



Cantilever

Deck Girder



Steel Arch

Tunnels

In those cases where a ridge or hill must be passed by a railroad, a tunnel may be the economical solution. The engineers have to estimate the costs of tunnel construction versus alternative track arrangements to bypass the obstacle, and then the railroad managers have to evaluate the effects on their operations of the alternatives. In the United States, tunnels have been the chosen alternative in over 1500 locations.

Tunnels were not a new idea, having already been found useful for canals. The earliest canal tunnel was built in France in 1678. Even in the United States there were at least two canal tunnels before the first railroad tunnel was built.

A tunnel is simply a hole bored through a mountain or hill. The construction crew works its way through the mass with drills and explosives, attacking the *face* of the tunnel and removing the debris. Where practical the tunnel is built from both ends towards each other to speed construction. In some cases shafts are sunk from the top of the hill down to the tunnel elevation and new bores are built out from the middle, increasing the working faces.

The earliest railroad tunnels were dug with hand drills and black powder. Later in the 19th Century pneumatic drills became available, as did a superior explosive, nitroglycerine. Tunneling could be dangerous work, especially under rivers when added precautions were necessary to prevent collapse.

A common practice was to send the tunneling parties ahead of the railroad so that the tunnel might be ready when the tracks reached it. In America, railroads often built some expedient track to get the line operating while work progressed on tunnels that would eventually become the mainline.

The longest through railroad tunnel in the United States is the 7+ miles Cascade Tunnel finished by the Great Northern (now Burlington Northern) in 1929. The shortest tunnel in the United States is the 10 yard Bee Rock Tunnel finished by the Louisville & Nashville between Kentucky and Virginia in 1891.

The longest railroad tunnel in the world is the 33+ miles Siekan Tunnel in Japan between the islands of Honshu and Hokkaido. Slightly less impressive is the 30 mile Channel Tunnel or "Chunnel" between Britain and France, expected to be completed by 1993.

OPERATING A RAILROAD
Passenger Service

In the United States today less than 3% of railroad revenue comes from passenger service, mainly because travelers prefer the convenience or speed of automobiles and airlines. In Europe and other areas this is not the case because greater congestion and population densities make railroads important people movers, and automobiles and highways are not as commonplace.

Historically, however, passenger traffic was significant. The earliest railroads were planned to be freight haulers, but the large revenues that quickly materialized for carrying passengers were a pleasant surprise. Not only did travelers abandon the road coaches of the day, but new travelers flocked to the stations, attracted by the speed, low cost, and novelty of rail travel.

For most of the 19th Century and the early part of the 20th, railroads were the prime means of intercity transport. By the early 1900's industrialized nations were crisscrossed by tracks reaching every community. You could reach any town in the country by train. The alternative remained travel by coach or horseback on often poorly maintained roads.

Catering to the demand of the growing middle class, railroads regularly scheduled passenger trains promising speedy and comfortable service. Salon cars, bar cars, dining cars, sleeping cars, observation cars, and others were designed to enhance the experience of traveling by train, even overnight.

As part of their publicity campaigns and competition with each other, railroads in the Golden Age invested disproportionate funds in their passenger service. High speed luxury trains, rigid timetables, elegant hotels, restaurants, and elaborate stations all served to impress the public with the grandeur and prominence of the providing railroad. The public goodwill and prestige earned by highly visible passenger service was expected to make the railroad more attractive to freight shippers and investors.

Passenger service was generally divided into three modes: local trains that stopped at every station along their route, through trains that covered a larger route making only a few stops, and the crack prestige trains normally running between major terminals at each end of the railroad. In addition, passengers often had a choice of travel

classes as well, and could pay higher fares to travel in privacy and luxury. This was especially true in Europe.

Local trains were relatively slow, stopping at every small station between two major terminals. For example, a local train might stop at all stations between New York and Philadelphia, connecting passengers in the smaller communities with the major cities at the route's ends.

At the same time, through or limited trains ran non-stop, or with only a few stops, back and forth from major cities that generated enough traffic to support the service. A through train from Philadelphia to New York might stop at only a few communities, such as Trenton. A person wishing to go from Princeton to New York could catch the local to New York, or the local to Trenton and then catch the through train to New York.

On important routes such as New York to Chicago or London to Edinburgh, railroads put on crack trains and competed fiercely for the honor of providing fast and luxurious service. It was believed that these crack trains were the main standard by which the railroad was judged, so every effort was made to keep the quality of service high. Normally these trains covered long distances making few, if any stops.

By the end of the Golden Age, many of the crack trains were as well known as the railroads that operated them. Examples of crack trains were the New York Central's 20th Century Limited, the Pennsylvania's Broadway Limited, the Santa Fe's Super Chief, the London & North Western's Irish Mail, the London & North Eastern's Flying Scotsman, and the Orient Express.

In North America, the decline in intercity passenger traffic is directly linked to the automobile, the extensive highway system, and airline growth. By the late 1960's passenger traffic had dropped so much that many railroads were facing bankruptcy trying to maintain service mandated by Federal law. Ultimately, most of the intercity traffic was taken over by a government corporation, Amtrak, that now provides this service on a much reduced scale. However, Amtrak is still not profitable and requires a large government subsidy to maintain operations.

Freight Service

The principle business of railroads has always been the hauling of freight. The first railroad of any kind was built to haul coal, and the first train pulled by a steam locomotive carried iron ore. As railroads developed into common carriers, prepared to haul anything in their cars along their tracks, they came to carry every cargo imaginable.

The earliest freight cars were wagons modified to run on rails. Some of these were built to haul specific cargos such as coal and ore, but most were just open wagons into which sacks and barrels could be packed. The transfer of freight to and from train cars was handled by brute strength at a rudimentary station building or platform. As railroads and the demand for their services expanded, new equipment and techniques were developed for handling and shipping cargos.

One advance was designing cars to carry specific cargo types. Among the earliest of these were hopper cars to carry bulk items such as coal, ore, sand, and gravel. The familiar box car replaced the wagon as a general cargo type, providing protection from the weather. Flat cars remained useful for odd shaped items. Later developments were tank cars for transporting liquids, gondolas (a flat car with low sides), livestock cars, refrigerated cars (first with ice and then electric cooling), mail cars (for sorting mail enroute), and others.

The history of the railroad freight business has been a continuing evolution of the process of getting the shipper's freight onto a train for shipment, and off again for delivery. Railroads are undeniably efficient once the cargos have been placed into trains, but the efficiency can be squandered if pickup and delivery are too costly.

The first freight cars were mainly loaded at a stop or station on the line where the cargo was moved from wagons onto the train cars. At the other end, the receiver's wagons picked up the load. The work was done mainly by hand and was slow, but was the only alternative for small, less-than-carload shipments. For shipments the size of an entire carload, other transfer methods were developed.

An early idea was to set up an area of *team tracks* and access roads where shippers loaded and unloaded entire cars that they arranged to meet. The name is retained from the days when wagon teams met the trains. If a customer consistently generated sufficient business, tracks were laid to his door, and cars were directly delivered and

picked up by passing trains. For a consistently large customer, such as a coal mine, entire trains provided service, special chutes or docks were built to speed loading and unloading, and even special cars were built, as noted above. In these ways the process of transfer was speeded up for both the railroad and customer.

In a manner similar to passenger trains, freight trains were scheduled as local trains, through trains, and even some express fast freights. In addition, there was the unit train.

Local freights originated at a major freight yard on the line, and would travel on to the next yard, collecting and setting out cars at the sidings of shippers. Starting out with cars to be delivered to shippers along the way, it would reach the other yard made up of cars filled by businesses for delivery elsewhere. When the local freight reached the yard at the end of its route, it was broken up and the individual cars were placed into through trains headed to a distant yard destination. At its destination yard, the through train was broken up and its cars placed in another local freight for delivery.

Through trains traveled non-stop between major freight yards and were made up in the yard of cars collected by the local freights for delivery elsewhere on the line. A through freight might stop at several yards along the route, adding at each a few more cars also headed for the train's destination.

The crack, or fast, freights moved valuable or perishable cargo that required fast shipment, such as milk, livestock, produce, etc. They generally traveled non-stop from one yard or customer to their destination.

The unit train is made up entirely of one cargo, usually carried from one shipper to one destination, and is an example of railroading at its most efficient. Most unit trains carry coal from a mine to a port or steel mill, where the coal is quickly unloaded by special equipment. Unit trains may travel thousands of miles without a consist change and can weigh up to 13,500 tons with their locomotives.

Each business day in North America, approximately 100,000 freight cars are loaded at industrial sidings, at team tracks, or by special equipment such as coal chutes. The average freight train consists of 66 cars, weighs 2080 tons, and travels at 17 mph,

including all delays enroute. Within that average, however, are many varieties of trains such as a local delivering newsprint to a downtown newspaper, a long drag of coal cars headed from Virginia coalfields to Norfolk, or a fast freight of California produce headed for New York.

Making Up Trains

Trains are assembled in freight yards or terminals under the direction of a car distributor. His job is to supervise the break up of each train entering the terminal so that cars are placed into proper trains for the next stage of their journey. He receives information from the yard crew and the railroad's computers on what is arriving, and balances this information with empty car requests from shippers in his division and orders from other car distributors elsewhere on the line.

The car distributor makes up a switch list that tells the yard crews on which tracks and in what order the new cars are to be placed. Within the yard certain classification tracks are assigned to each of the new trains being made up, the west bound local, the east bound local, the through freight to the next major terminal, etc. Within these trains, cars headed to similar destinations, such as a paint or furniture factory, are kept together in blocks. Blocks are placed in the trains in the order that they are to be dropped off.

The work of the yard crew is done by either flat or gravity switching. In flat switching a relatively light locomotive is used to get the waiting cars and place them into the new train. This is a slow and laborious process, requiring many engine movements, track switches, and a nimble crew. This push-and-pull switching has been part of railroading from its earliest days, and is still carried on in all small yards and even some large ones.

Where possible, railroads alternatively employ gravity switching. In this process the arriving train is slowly pushed up a hill or hump, and each car is automatically uncoupled at the summit. The free car then rolls down the hill and is switched and braked from a control tower so as to arrive in the correct classification track. The work of the yard crew is reduced to pushing the train over the hump. The classification work is done by the tower staff.

A hump yard was first successfully operated on the London & North Western at Edge Hill, near Liverpool, in 1873. The Pennsylvania Railroad opened the first American hump yard in America at Greensburg in 1882. In these early yards, men were stationed at each switch down the hill and signalled to properly direct the cars. Other men actually rode the cars down, turning the brakes by hand to control car speed. Cars were classified by clerks who checked the waybills from the arriving conductor and marked the cars with chalk.

Today the hump switches are controlled electrically from the tower, and the cars are slowed by retarders along the tracks that squeeze against the wheels as they pass. The drop of the hill and the classification tracks are carefully designed to help control car speed. Cars are classified by electronic codes read off their sides, and the information is almost immediately available on the tower's computer. A single hump yard can classify up to 1500 cars in an 8 hour day, and as many as 3,500 in a three shift day.

Once the classification is complete, the train is pulled forward into a departure yard, and road locomotives join up. In some cases the classification yard produces only blocks of cars, and in the departure yard the blocks are assembled in station order to be dropped off, and then the road locomotives join. At this point the train is ready for its journey.

Moving Trains

The primary revenue producing railroad operation is moving trains from one place to another. In the United States today the average mile of track in freight service carries about 5.5 trains per day. However, 67 percent of the traffic travels over only 20% of the existing mileage, so the mainlines carry much more of the load.

Once all the track and yards are in place, the efficient movement of trains depends on having the correct locomotive available for power, a safe way of controlling congestion, and a good mix or schedule of trains operating to meet the demand for service.

When the early railroads converted from horses to steam, many loaded cars could be put into a train because of the enormous increase in motive power. The first steam locomotives were not differentiated by task, but as the technology improved, some designs were found

capable of greater speed and others more pulling power. At this time the distinction began to be made between smaller fast trains, primarily for passengers, and slower, more powerful trains, primarily for freight.

Fewer but larger drive wheels produced higher speeds when pulling relatively light loads. This resulted in the popular American and Ten-Wheeler designs in the United States, and the graceful single driver locomotives in Britain. These locomotive types remained useful and popular from the 1840's until the 20th Century, when increased train sizes and new technology passed them by.

Where pulling power was more important than speed, especially over the grades typically found in North America, new designs such as the Mogul and Consolidation developed. With their heavier weight and greater traction, they were capable of pulling greater train weights and climbing grades. In England the 0-6-0 goods engine performed a similar service for many years with very little design change.

On United States railroads today, diesel-electric locomotives provide most of the power, and they have proved to be much more versatile than their steam ancestors. Only six different basic locomotive types are now being built, ranging from light industrial switchers to Amtrak's 3600 horsepower passenger engines. These types are differentiated by horsepower and traction, and within types, gear ratios can be adjusted to change running speeds.

A railroad meets its power demands by choosing a locomotive type of certain gear ratio, and linking several engines together if necessary. In this way an efficient amount of power, traction, and speed is provided for moving the train in question.

Once the train is powered and ready to move, it is placed in the hands of dispatchers who control movements over the road. The track of the railroad is divided into manageable parts, usually called divisions, each with its own dispatcher. His job is to move trains over the tracks efficiently and safely. He must allocate a limited resource, space on the tracks, among the waiting trains so that the railroad fulfills its obligations with a minimum of trains sitting idle.

To help dispatchers do their jobs, trains historically have been rated for importance, with higher class trains being given priority over

others. The highest value trains are normally the fastest, as well. Dispatchers organize train movements by first planning the schedule of the highest value train, then the second highest value, etc.

Passenger and express freight trains were normally given priority over freight trains due to the relatively high revenue of a passenger train and the high public profile of the passenger business. Among passenger trains, the crack express trains were normally given priority over their entire route. Next in value were through trains. Local passenger trains still had priority over most freight trains, but occasionally an express fast freight was more important.

Among the freight trains, regularly scheduled fast freights were normally given priority, but a special freight that was put on might override the normal arrangement. The lowest priority freights were the locals, stopping many times along the division to set out and pick up cars. They had to get out of the way of just about everything.

Once the dispatcher has an understanding of the priority of trains expected to pass over his division, he plans how the movement is to take place and passes out the orders to the trains. In these orders the conductors on the trains are told when the train should be at various points on the line. If this timetable is followed then the railroad should be running efficiently.

The dispatcher then oversees the movement of trains from his tower by keeping track of their location on a control board. On this board are displayed the various tracks and switches of the line and the current positions of all trains, stopped or moving.

The track of the division on the board, as well as on the line, is divided into blocks by signal towers. Once a train has entered a block, that block is normally closed to all other trains until the first train has passed through. By this system, if the signals are properly obeyed, collisions are avoided.

Inside each train's locomotive, the crew conducts the movement of their train as ordered. The dispatcher monitors their position on his board by messages from signal towers reporting passing trains, and from direct communication with the locomotive crew if necessary. Due to any number of factors such as accidents, engine trouble, bad weather, etc., the dispatcher's original plan often must be modified.

By changing signals and switches, the dispatcher can hold up or reroute certain trains to let others pass.

The crew on the train can only control whether the trains moves forward or backward, and train speed. Where the train moves is controlled by how the dispatcher sets the switches the train passes over. By his control of switches, signals, and train orders, he orchestrates the movement of the trains.

On some parts of the railroad, especially in mountain districts or on single tracks, the movement of trains presents especially interesting problems for the dispatcher and train crews. Where the problem is an extended region of steep grades that sharply reduce train speed, the solution is often to change locomotives at the beginning of the mountain region. More powerful mountain engines pull the train over the grades, and then hand the train over to lighter engines more suited for speed on the level land below.

Where the problem is a single relatively short grade and the line is not crowded, an alternative solution is *doubling the grade*. In this maneuver the locomotive takes half the train only to the top of the hill, leaves it in a summit siding, returns for the the other half, and then rejoins the parts at the top and continues downhill.

Another solution to the grade problem is adding helper engines, either as pushers or double heads. A pusher engine joins the train at the bottom of the grade by coupling on the end, and then applies its power to the back of the train. When the summit is reached the pusher uncouples while moving and the train continues with minimum stopping. Double heading places an extra locomotive at the front of the train. This requires more switching and time, but is desirable for passenger trains because it reduces the discomfort that normally results from the combination of pushing and pulling engines.

On single tracks the dispatcher must deal with trains coming together from opposite directions, called *meets*, and faster trains overtaking slower trains, called *passes*. Operations on single track roads require the judicious placement of double-ended passing tracks where trains can pass each other. Passing tracks are designed to hold entire trains where possible, but terrain, right-of-way cost, and local

ordinances often prevent this and the dispatcher must keep in mind the variable size of sidings when planning meets.

Where one or both meeting trains do not fit on sidings they must stop and maneuver past each other by breaking up the trains and moving manageable parts back and forth until they are entirely clear. These maneuvers are known as *saws* when one train only can fit on the passing track and *double saws* when neither train fits on the passing track.

An efficient railroad keeps an adequate schedule of trains running along its routes to provide service that is competitive. This schedule depends on a proper mix of locomotive and car types being available and proper management of moving trains by crews and dispatchers. An inefficient railroad can have the wrong equipment attempt a task, raising costs, offer an inadequate schedule, or regularly fail to meet its schedule and lose customers to the competition.

STEAM LOCOMOTIVES
Introduction

The enduring symbol of railroading is the steam locomotive, one of the most marvelous and fascinating machines that man ever created. They were tangible proof in their time of mankind's ability to conquer the known world with technology. In the span of one generation, the speed limit at which people could travel rose from the few miles per hour limit that had remained constant since the domestication of the horse, to nearly 100 mph. For their day they were a combination of the automobile, the airplane, and the space shuttle.

The marvel of the machines is that they were so large and so solidly heavy, yet could move so fast and so gracefully. That they could move at all seemed a great achievement when their mass was viewed up close, and it was difficult to comprehend how the power was generated to pull the enormous loads they dragged. They were incredible machines in their day, consisting mainly of a fireplace and a tank full of water, but capable of great power and speed.

The fascination with steam locomotives derives from their physical presence and from watching, smelling, and hearing them work. Standing next to one of the last generation of steam locomotives, you cannot help but feel dwarfed by its height and breadth. The polished connecting rods look like the largest wrenches ever made, and the top of the drive wheels are at eye level or more for most people. Standing near a moving locomotive you feel the perceptible tug of the machine driving past, pulling the wind with it, and sucking you off of your feet.

At rest the engine gives little indication of its capability. The only apparent movement in a fired up locomotive are tendrils of smoke and steam, and possibly the preparations of the train crew. In motion, the locomotive is the picture of undeniable, massive power. The wheels turn, the burnished connecting rods shimmer, the dust rises, and the smoke and steam puff from the stack, all in a delightfully precise choreography.

The smells of the locomotive are the smells of engines: oil, grease, coal, hot metal, a roaring fire, and boiling water. This is the no nonsense smell of work being done.

The sounds of a steam locomotive give it credence as a living, breathing being. The hiss of an idle engine sounds like the boiling of the giant teapot that the locomotive nearly is. The chuff-chuff of steam

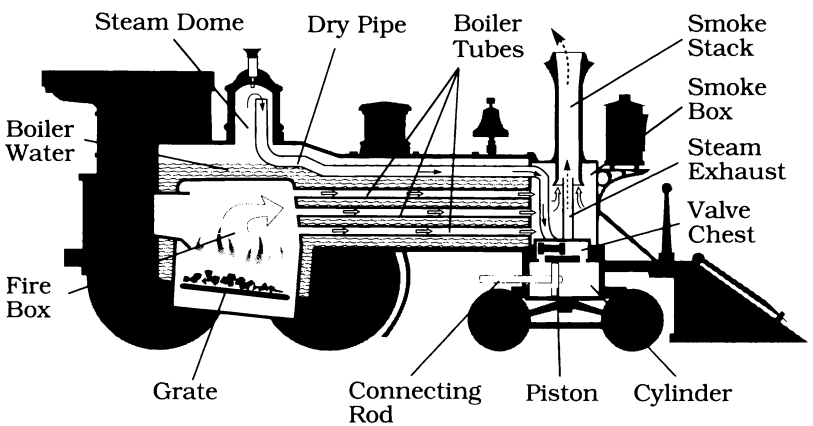
escaping the cylinders and venting through the stack is the breath of this colossal iron horse. The blast of the steam whistle, whether in the distance or up close, is the call to travel and adventure. The clanging bell of a locomotive approaching a station means your wait is just about over, or your adventure is about to begin.

In most of the industrialized nations, the steam locomotive no longer works hard for a living, but is kept running as a tourist attraction or museum piece. That so many are still operating is a testament to the fascination they inspire.

Making Steam

When water is heated in a container, it begins to boil, or be converted into a hot gas of water vapor called steam. The important factor in this process is that steam takes up a much greater volume of space than the equivalent amount of water, over 1500 times as much space. If the steam in the container cannot escape, the energy of expansion becomes pressure building up inside the container. If the pressure gets high enough it splits the container open.

Steam Locomotive Boiler



The objective of all steam engines is to capture the pressure of the expanding steam and make it do work. This is usually accomplished by building up the pressure to a certain level in a boiler, and then opening a path of low resistance that the pressurized steam can escape down. Along the escape path, however, the steam must push a partially resistant blockage out of the way. This blockage is a piston, and the steam pressure forces it back down a cylinder until a valve opening is uncovered allowing the steam to escape.

By opening and shutting separate escape paths from the

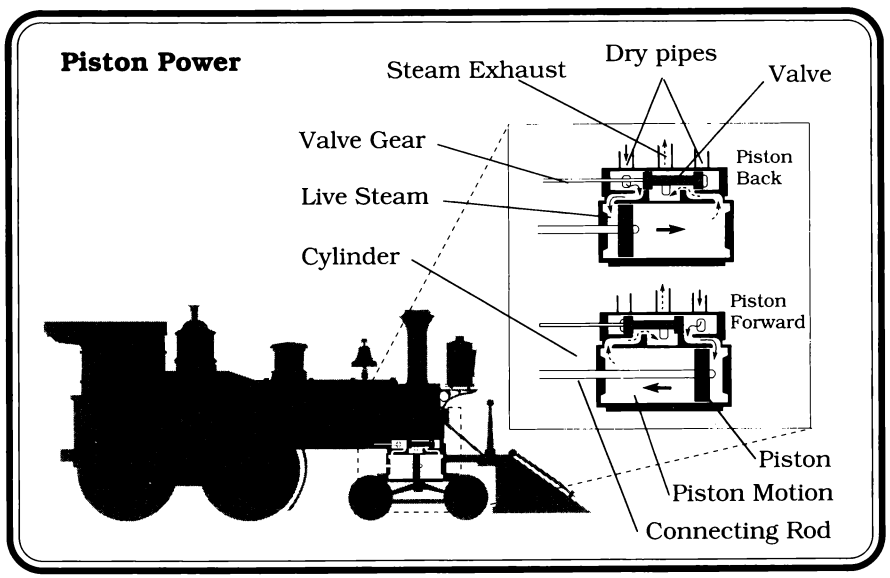
boiler, steam pressure is alternatively directed to opposite sides of the piston, pushing it back and forth. This push-pull motion of the piston can then be converted to power.

The first step in making steam in a steam locomotive is to boil water. This is done in the boiler, the long tank that makes up most of the length of the locomotive. At the back of the boiler, just in front of the cab where the crew is located, is the fire box. In the fire box the fire is built that heats the water. In the early locomotives wood was the usual fuel, but coal became more common later on. Some locomotives burned oil where it was cheaply available.

The fire is fed by hand or automatic loaders. The draft necessary to provide oxygen comes from a grate at the bottom of the fire box and is pulled through the box and out tubes that extend through the boiler to the smoke box below the smokestack. Air passes through the grate and is heated in the firebox. As it passes down the tubes to vent out of the stack, it heats the water that surrounds the tubes in the boiler. In this way the heat of the fire is transferred to the water, making it boil and convert into steam.

Inside the boiler the steam begins to accumulate, gradually filling and expanding. When it tries to expand, it has no outlet and the pressure inside the boiler increases instead. When the pressure gets sufficiently high, the locomotive is said to have "steam up" and be ready to move.

While the locomotive is getting up steam, the crew is overseeing the process. The fireman is responsible for building the fire and maintaining sufficient water in the boiler. The engineer lubricates the connecting rods and other working parts of the locomotive, inspecting it for any prob-



lems. As steam builds the engineer keeps track of the pressure to be ready when the locomotive can move.

Steam Power

When the steam pressure is sufficient, the engineer opens the throttle. This opens the escape path for the steam down the "dry pipe" to the cylinder valves and pistons. The valves pass the steam through into the cylinders where the steam builds up pressure against the piston. The piston is designed to give way under sufficient pressure and it begins to move backwards.

The pistons are connected by massive rods and other connecting gear to the drive wheels. The motion of the pistons is converted by the complicated connecting gear into movement by the wheels in one direction, either forward or backward.

At the same time, the cylinder valve over the piston is connected to the wheels and the wheel motion moves the valves back and forth. The motion of the valves opens and closes vents into and out of the piston cylinder for the entry of new steam and exhaust of spent steam from the opposite sides of the piston.

The engineer controls the speed of the locomotive with the throttle. By opening and closing the throttle he lets more or less steam into the cylinders. The amount of steam let in controls how fast the pistons move back and forth, and thus the speed of the engine.

Development and Decline

By the 1850's, most of the basic principles of steam locomotive power had been discovered. Thereafter, the development of the locomotive was a matter of making them larger and more powerful, and only a few significant advances in technology were made. The larger weight and increased power was made possible by the availability of cheap steel that could be made into the heavy rails necessary for the support of heavy trains and engines.

One of the most important later inventions was the idea of using the exhaust steam from the cylinders, now low pressure steam, to power a low pressure cylinder. This was called compounding, and the massive compound engines of the 20th Century were the pinnacle of steam locomotive development. The Union Pacific *Big Boy*, a 4-8-8-4 weighing over 500 tons, was capable of generating over 5,000 horsepower.

Steam locomotives were made obsolete by the development of the diesel-electric locomotive in the 1930's, even though steam power continued in use on North American roads into the late 1950's.

The advantages of the diesels were mainly that they were cheaper to operate and more reliable. Diesels could be linked together in tandem under the control of one crew and do the work of several steam locomotives and crews. Diesels also converted more of the energy from their fuel into power.

Despite their obvious inferiority, however, steam locomotives are still in use in a few nations, notably China and South Africa, where coal is plentiful and oil dear. In addition, railroad buffs and museums in the industrialized nations have preserved a remarkable number of operating steam locomotives. The thrill of seeing a steam locomotive in full flight is still to be felt, even if only on Saturday afternoons.

7
NOTES AND CREDITS

RAILROAD TYCOON WORLDS

Map Generation

When starting a new game of Railroad Tycoon you choose one of 4 different worlds for the location of your railroad. Your choices are:

Eastern USA, 1830
Western USA, 1866
England, 1828
Europe, 1900

Each world approximates the geography of the region portrayed, but no world exactly duplicates the real geography. Each new map is generated from a base map that represents the economic geography prior to the time period of your game. From this point a new mix of resources and industrial growth is placed.

As a result of this process, each game you play must be different because the growth of cities and location of industry is never the same. In one game New York is a great city, but in the next it may be just a village. The best location for railroads is therefore different from game to game.

Once you have made your opening choices of play options, the game begins by placing you at the Regional Display. In order to read the map of this display you must refer to the Regional Map Chart in the Technical Supplement. This chart explains what type of geography is represented on the map by each color.

Specific Map Features

The worlds in Railroad Tycoon differ slightly in the mix of resources and industries that are present. These separate mixes result in some different cargos being available only in one world or another. For a description of the map icons and what they represent in each world, refer to the World Economies Chart on the Player Aid Cards.

The Western USA world has some unique features. Revenue earned for carrying cargos on east-west routes are double what would be normally expected. Revenues earned for carrying cargos on north-south routes are half what would normally be expected. These effects are designed to encourage east-west railroads. In addition, completing a railroad connection from the east side of the Mississippi River on the right side of the world to the Pacific Coast on the left side of the world earns a $1,000,000 bonus for achieving a transcontinental railroad.

Game Scale

The four game maps have been built in a square grid. Each position on the grid is referred to as a map *square* throughout this manual. The speed of trains, the distance they travel, and the distance effect on revenue earned is kept consistent between the worlds, despite the fact that the worlds have been built to different scales. In addition, adjustments are made when building or traveling in a diagonal direction to account for the difference in distance when traveling diagonally, as opposed to horizontally or vertically within a grid.

Game Time

A game of Railroad Tycoon is broken into fiscal periods for accounting purposes, and each period lasts two years. At the end of a fiscal period, you are normally shown a number of fiscal reports to review that concern your railroad and any competing railroads that may exist.

While your reports detail the operations of your railroad for two years, the numbers are actually derived from the operations of your trains for only one 24 hour day, converted into what would be expected from these operations over an entire year. The operation of one of your trains in the 24 hour period, represents many trains running that route over the two years.

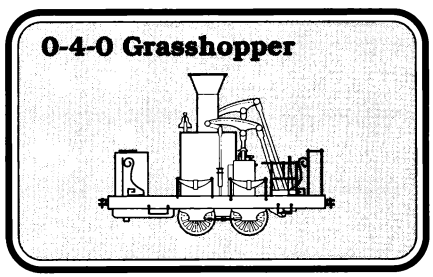
When a Train Arrival Announcement reports the arrival of one of your trains at a station, the time of the arrival is also noted. The hour of the arrival corresponds to the 24 months in the fiscal period. 12:00 AM corresponds to January of the first year, 1:00 AM to February of the first year, etc.

Locomotive Roster

The locomotives included in Railroad Tycoon were chosen to represent important historical designs and evolving technology. When each game begins, only one or a few locomotive types are available for purchase by your railroad. As time passes, technology improves and better locomotives can be purchased. Eventually the older types cease production and are thereafter not available.

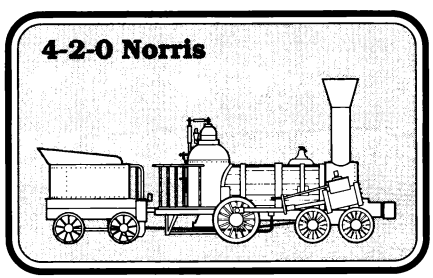
Each locomotive included in the game is listed below with an illustration and descriptive notes. Included with the notes are some suggestions on how best to employ the locomotive types in the game. The North American locomotives appear in the Eastern and Western USA games, and the European engines appear in the England and Europe games.

North American Locomotives



0-4-0 Grasshopper: The first of these locomotives was built by Phineas Davis of York, Pennsylvania, winning a $4,000 prize offered by the Baltimore & Ohio Railroad for a 3-1/2 ton coal burning locomotive. They were called grasshoppers because their motion resembled that insect. They were front heavy, moving with a pitching motion, and their vertical rods moved up and down to power the wheels like a grasshopper's hind legs. These four wheeled vertical boiler engines were ideal for the sharp curves of the B&O and were the railroad's main power by the mid-1830's.

These are the only locomotives available at the start of a game in the Eastern USA, so you have no choice. Use them for everything but note they are not particularly fast, even when pulling only one car.

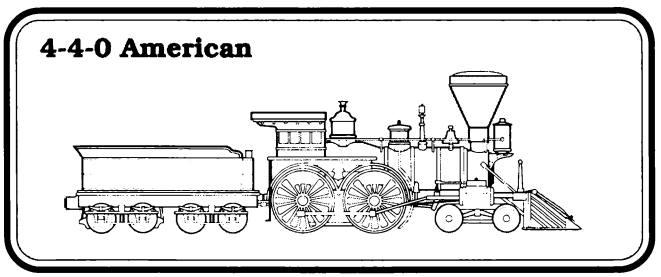


4-2-0 Norris: William Norris of Philadelphia built the first of his Norris type locomotives for the Philadelphia & Columbia in 1834 and its performance, especially on a steep incline, was sensational. The design was simple, sturdy, and versatile enough to be useful throughout America, and influence European designs as well. The Norris type was noteworthy for its bar frames, outside cylinders at the smokebox, the Bury firebox, and placement of the driving axle in front of the firebox to improve adhesion.

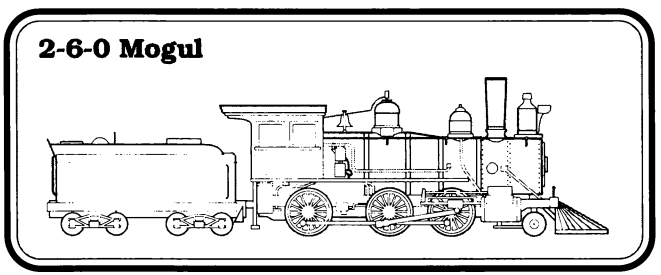
This is the first modern locomotive available in America and the performance of your trains can be substantially improved in both speed

and pulling power by replacing your grasshoppers with it. No other locomotive replacement has this impact.

4-4-0 American: The most popular locomotive type in North America from the middle to late 1800's, with over 25,000 being built. Noted for its ability to handle heavy loads over varied routes, its ability to operate over uneven tracks, simple construction, low initial cost, and ready maintenance, it was the ideal general purpose locomotive for the period of westward expansion. It became the national engine because it answered every need.

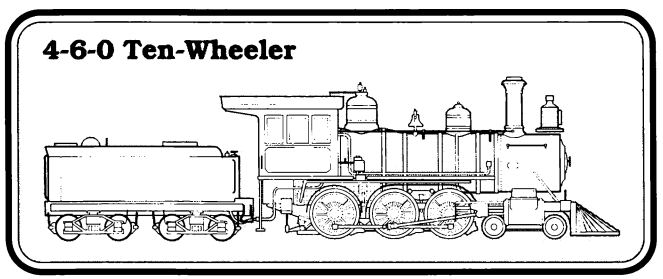


Use the American for most of your long haul trains, especially those hauling passengers or mail. When cars are kept to three or less, this locomotive can maintain very good speeds.



2-6-0 Mogul: The mogul engine type was developed to power heavy, fast freight trains that were too much for the American type which it bettered in tractive power by nearly 50%. The wheel arrangement had been tried as early as 1852, but a really successful mogul engine was not built until 1864. The mogul type was on its way to replacing the American as a national type, at least for freight service, but was itself replaced by the 2-8-0 before it was firmly established.

By the time this locomotive comes available, you may be running large or long freight trains. Add a car or two to these trains if the business is there, and put Moguls at their head. These trains can then maintain their previous speed, while delivering more cargo. Placing a Mogul on a passenger train, however, is wasting money.



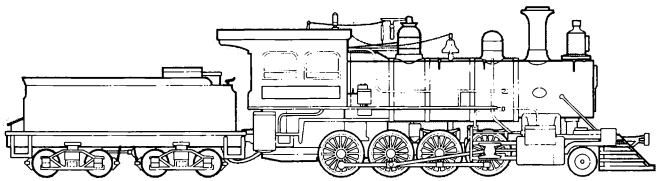
4-6-0 Ten-Wheeler: This was the second most popular wheel arrangement of the 19th Century in North America, and it began to seriously rival the American after 1860. First used as freight engine, it

was recognized by the 1850's as useful in general service. By the 1880's the dogma of specialized motive power for each class of service relegated the Ten-Wheeler to passenger service. It served on mainline passenger trains until about 1910 when heavier engines were required.

Use this locomotive for high speed trains carrying mail, passengers, and fast freight. They can maintain the speed of Americans while pulling one or more additional cars. Alternatively, put them on long runs with a few cars and they set speed records.

2-8-0 Consolidation: This wheel arrangement was originally introduced in the late 1860's for slow pusher service, but by the middle 1870's its value as a road engine was recognized. It was built in larger numbers than any other single wheel arrangement, approximately 33,000 between 1866 and 1950. The original Consolidation was designed by Alexander Mitchell in 1865 and incorporated all the elements that made the 2-8-0 a success. When the Erie replaced its 4-4-0s with Consolidations in 1876, it found that the heavier engine could pull trains of twice the weight, while reducing expenses from 96 cents to 53 cents per ton-mile.

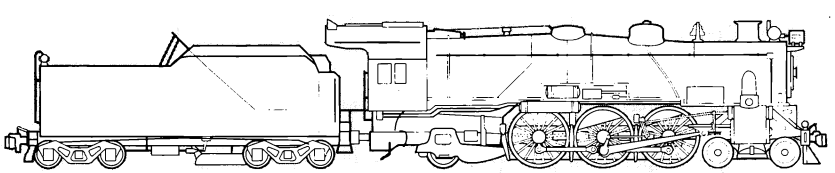
2-8-0 Consolidation



Use this locomotive for long, heavy freights, or for trains passing over steeper grades.

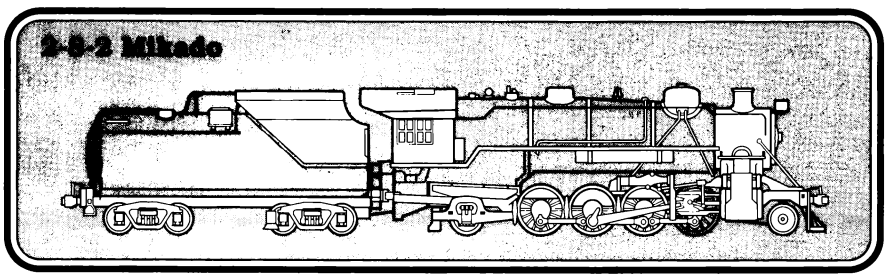
4-6-2 Pacific: Baldwin Locomotive Works claims the first Pacific type, delivered to New Zealand in 1901, although locomotives going back to 1889 had the wheel arrangement. Early into the 20th Century the Pacific became the preferred locomotive for almost all express passenger

4-6-2 Pacific



trains and many fast freights, and they remained useful after being replaced on the top trains in the 1930's by 4-6-4 Hudsons. About 7000 were built in the United States.

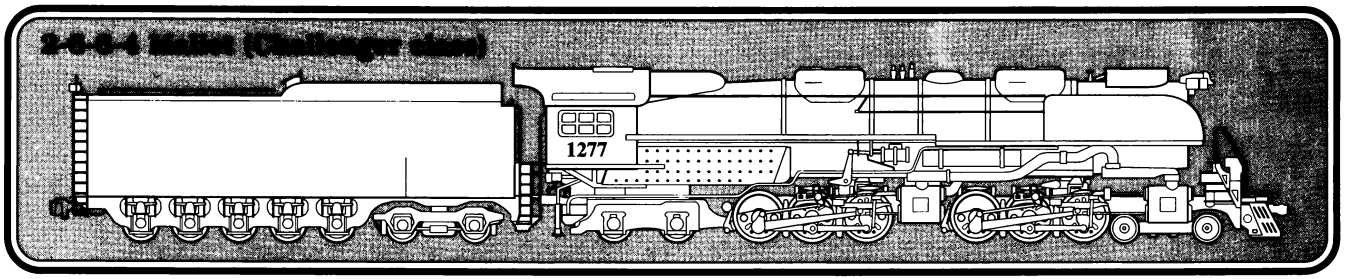
By the time this locomotive is available, you probably have some very long runs on your line. Use the Pacific to haul fast trains on the long distances. It can maintain very high speeds if not burdened with too many cars.



2-8-2 Mikado: The first 2-8-2s were built in 1897 for a railway in Japan, hence the name. The type was introduced in the United States in 1903, and it grew in popularity. It became the most common freight locomotive in the United States, partly because it was specified as an authorized design by the federal government when US railroads were briefly nationalized for World War I. They were again built in large numbers during World War II and exported after the war as part of the Marshall Plan. Although more often known as "Mikes" in the United States, during World War II their class name was changed to "McArthur" by sensitive railroad managements.

This is a heavy freight engine for pulling long trains. Use it to replace Consolidations when you want to add a car or two to the train consist.

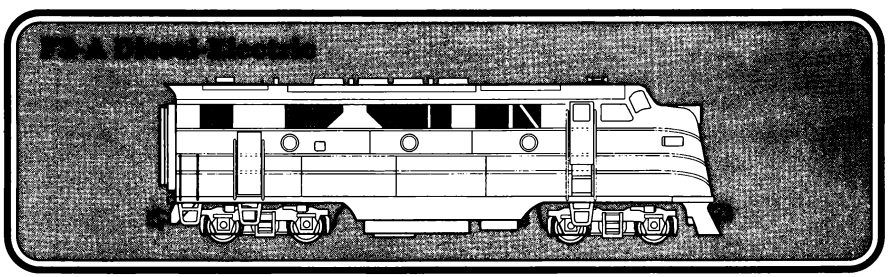
4-6-6-4 Mallet (Challenger class): In the late 1800's Anatole Mallet, a Swiss engineer, developed the design of the compound, or articulated, locomotive with a rear group of drive wheels powered by high pressure steam and a forward group of wheels powered by the residual low pressure steam. Work on this design continued with the first large mallet, an 0-6-6-0, appearing on the B&O in 1904. This type proved very popular as power for heavy freights and pusher engines. The final era of the mallets, and the final development of steam power, was marked by the Challenger class 4-6-6-4 locomotives that appeared in the 1930's. Weighing nearly 300 tons and exerting over 5000 horsepower, yet capable of running speeds over 70 mph, Challengers



were used for heavy freights and mountain passenger trains.

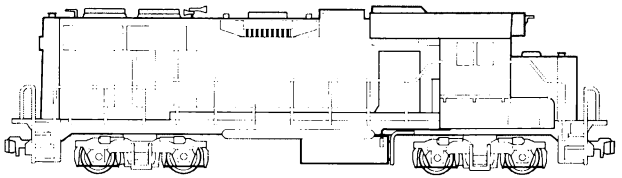
The most powerful North American steam locomotive in the game, use it for your heaviest freight trains and for passenger trains that must negotiate steep grades.

EMD F Series Diesel-Electric: In 1939 the Electro-Motive Division of General Motors sent a 4 unit diesel locomotive on a 83,764 mile tour over 20 major American railroads to demonstrate its capabilities. The demonstrator units consistently outperformed their steam competition and suffered no mechanical failure, convincing railroads of their worthiness. Within 20 years steam disappeared from American railroads. The demonstrators developed into the F series of cab (A) and booster (B) units that could be geared for variable speeds and equipped for passenger traffic. Over 7,000 F diesels were built until production stopped in 1953 due to the increasing popularity of *hood* diesel units and declining passenger traffic.



Useful for any train that is relatively small and needs to move fast, the diesels additional advantage is that their maintenance costs are substantially lower than steam locomotives.

EMD GP Diesel-Electric

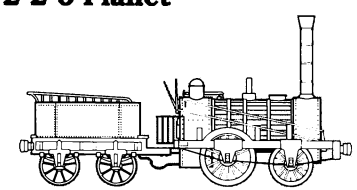


EMD GP Series Diesel-Electric: Responding to the desire of railroads for a *road switcher* locomotive, capable of switching as well as some road work, in 1949 EMD produced the first of its GP (general purpose) series. It was an immediate success and an improved version remains in production today. The structural strength of the locomotive is in the frame, and the hood serves only to protect the mechanical parts. In addition, the hood gives the engineer very good vision in both directions, and allows easy access to the motors. It is available in different gear ratios and capable of being linked together under the control of one engineer, making it very flexible in use.

Use the GP diesel to replace aging steam freight engines, because the GP, like the F series, has substantially lower maintenance costs.

European Locomotives

2-2-0 Planet



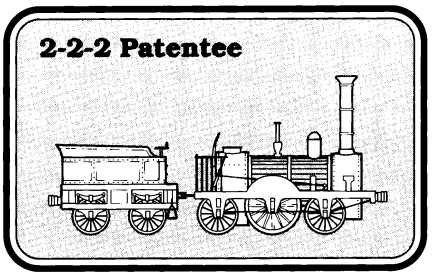
2-2-0 Planet class: Delivered by the Stephensons to the Liverpool & Manchester Railway in October, 1830, the Planet proved to be very successful for its day. Its major innovation was to put the cylinders at the front end, helping to distribute the weight of the engine. The Planet proved to the world that reliable steam locomotives could be built, and laid the foundation of the fortune of Robert Stephenson & Co., locomotive builders. However, the design was flawed by problems with forged crank axles and by its short wheelbase with the firebox outside it at the rear. Axles failed, and the engine had a tendency to pitch continually, threatening to derail.

You must use the Planet in England at the start as it is your only choice, but replace it as soon as you can when the Patentee becomes available. If possible, keep its train lengths to only one or two cars.

2-2-2 Patentee: The Stephensons continued to develop the Planet design, adding a third axle and removing the flanges from the large center drive wheels. The result was less force on the drive axle, lower axle loading on the the L&M's track, no pitching, and allowance for an even larger firebox. The improvements were patented, hence the

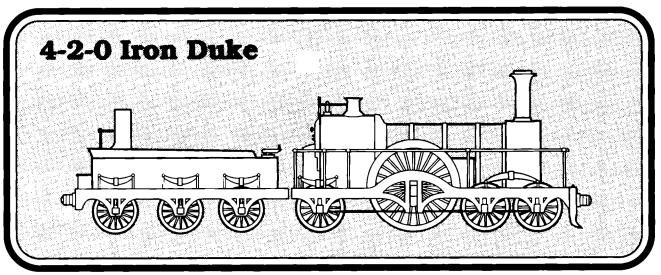
name "Patentee". The Patentee type, with variations and improvements, was constructed by most locomotive builders in England and Europe from 1835 to 1845. Patentees, built either in England or at home, were the first locomotives to run in several countries, including Belgium, Holland, Italy, and Russia.

The Patentee is useful for all types of trains, but should not be asked to pull more than three cars. It substantially improves the service of your road by easily surpassing the Planet in speed and power.



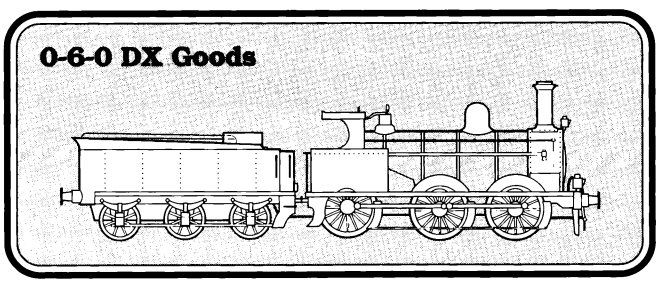
4-2-0 Iron Duke Class: The Iron Duke was an express engine designed by Daniel Gooch for the 7 foot gauge Great Western Railway and built in their own shops in 1847. The long wheel base made for stable running but required ample curves. The broad gauge allowed a larger firebox and thus greater steam production. These locomotives and their immediate descendants, the slightly modified Lord of the Isles class, were extremely successful, consistently demonstrating high speed and stability. Of the 29 Lords class built beginning in 1851, 23 were still in service on express trains in 1892 when the broad gauge was abolished.

Place these locomotives into service on all of your fast trains as soon as you can afford them. They can pull 2 cars at very good speed, and 3 or even 4 reasonably.

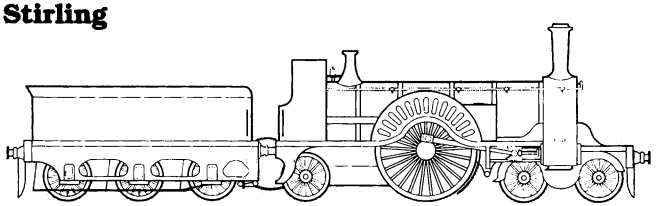


0-6-0 Dx Goods: A universal freight, or goods, engine designed by John Ramsbottom for the London & North Western Railway, the class was built from 1855 to 1872. They were simple but sturdy, and very popular with 943 being built, a record number for any type of English locomotive. They served for nearly all types of freight business, and after reboilering, some continued to run until 1930.

Replace any type locomotive on freight service pulling 3 or more cars with this locomotive as soon as possible. None of its predecessors can pull as many cars or climb grades as well.



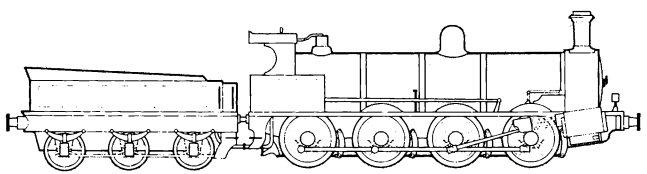
4-2-2 Stirling



4-2-2 Stirling 8 ft Single: One of the loveliest and most graceful steam locomotives, it is named for the Locomotive Superintendent of the Great Northern, Patrick Stirling, and its 8 foot single drive wheel. They were built from 1870 to 1893, and finally withdrawn in 1916. While the standard express train was 6 compartment cars, the Stirlings handled all of the crack passenger trains of the GNR, including the then unofficial 10 AM King's Cross (London) to Edinburgh "Flying Scotsman". The advent of heavier "corridor" passenger cars and dining cars, reduced them to lesser tasks.

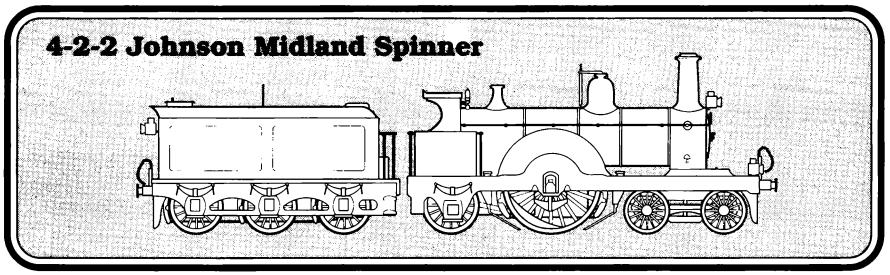
This locomotive should be placed at the head of your fast trains, especially those carrying mail and passengers. Don't burden it with more than 3 or 4 cars because under those conditions it slows considerably and loses much of its value.

0-8-0 Webb Compound



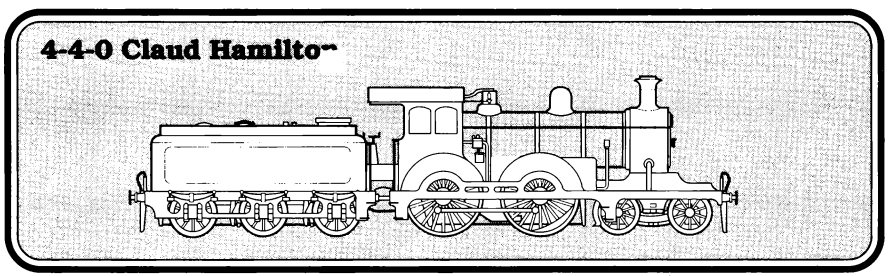
0-8-0 Webb Compound: Built by Francis Webb for the London & North Western to pull heavy coal trains, it was powerful but difficult to drive and expensive to maintain. The locomotive had outside high-pressure cylinders and a single low-pressure cylinder between the frames. In various modifications, over 470 were built and the last was not withdrawn until 1964. They were found especially useful in the mountainous regions in and near Wales.

Place the Webb compound on your long and heavy freight trains, especially those moving in mountainous regions. Don't waste its power on passenger trains.



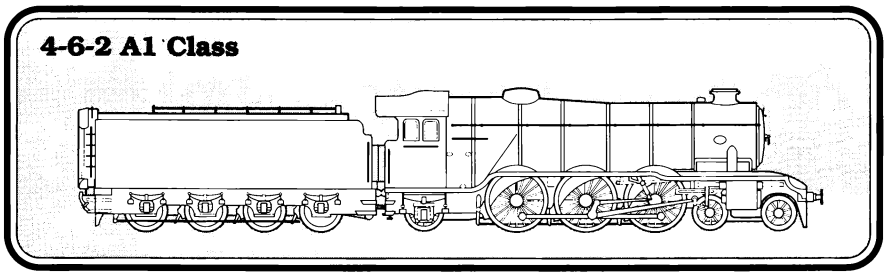
4-2-2 Johnson Midland Spinner: Though the single driver locomotive was thought obsolete by the late 1880's, Samuel Johnson of the Midland Railway designed this class, nicknamed Spinners, in 1887. The reason for his confidence was the recent invention of steam sanding gear which assured a steady supply of dry sand under the drive wheel, sufficiently improving its adhesion to make the design again practical. The Midland competed with other companies at all of its passenger stops but one, and consequently operated many light trains at good speed to attract business. The Spinners served this need well, and remained in service well into the 20th Century, beautifully painted with the Midland's distinctive crimson colors.

This locomotive is the ideal choice for a one or two car train that must travel at high speed.



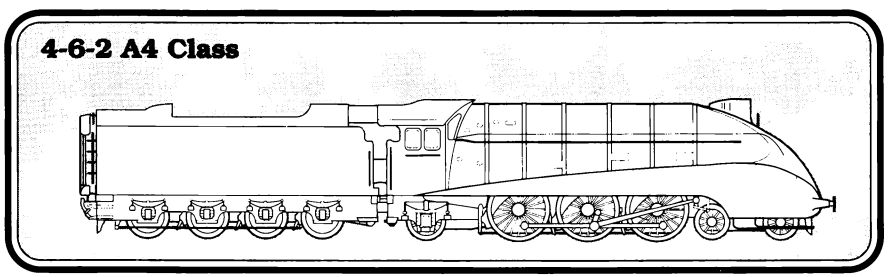
4-4-0 Claud Hamilton Class: Between 1900 and 1923, 121 of these engines were built by the Great Eastern Railway for light express passenger service, mainly from London to the Norfolk coast. They incorporated a number of design features considered to be before their time, including a large cab with windows, power-operated reversing gear, and a water scoop (for picking up water from a trough between the rails without stopping). In addition, they burned waste oil from the company's oil-gas plant. Other modern features included an exhaust steam injector and a variable mouth blast-pipe for adjusting the amount of exhaust steam sent up the stack to improve the draft in the fire box.

Another high speed locomotive for relatively light trains of 2 or 3 cars, possibly more if the grades are moderate.



4-6-2 A1 Class: The first class of Pacific locomotives to run in Britain, they were ordered in 1922 by Nigel Gresley, Locomotive Superintendent of the Great Northern Railway. Very attractive engines with graceful lines and a pleasing livery, they could pull as well as they looked. Beset at first with a number of irritating problems, after adjustment they established an excellent reputation. Beginning in the summer 1928, they ran the longest non-stop service in the world, 392 3/4 miles from London to Edinburgh. This was the Flying Scotsman, inherited by the London & North Eastern from the Great Northern when English railroads were amalgamated into four systems in 1923.

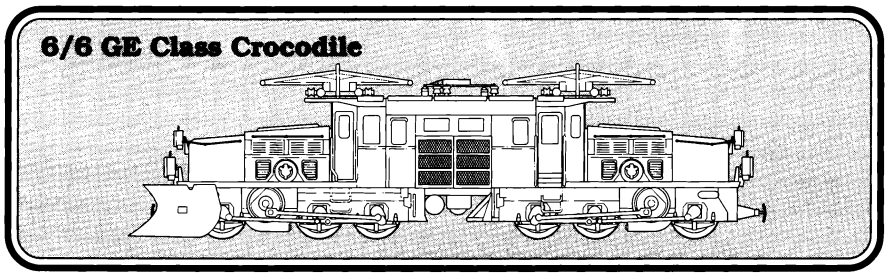
An excellent locomotive for longer passenger trains and fast freights, use it to upgrade any non-bulk or non-slow freight of 3 or more cars. Also very useful for trains trying to cross substantial grades.



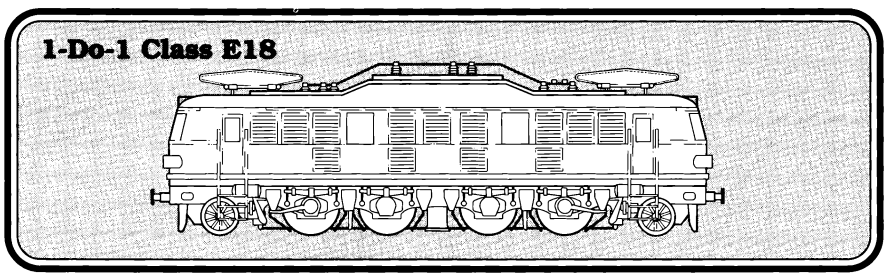
4-6-2 A4 Class: Possibly the most popularly known steam locomotive in Great Britain, this streamlined Pacific engine holds the world speed record for steam, 126 mph. Built from 1935 to 1938, they were not displaced from their role as express locomotives until the arrival of diesels in the 1960's. In the interim they powered the crack trains of the London & North Eastern, including "The Silver Jubilee" from London to Newcastle, the "Coronation", and the "West Riding Express".

This is the best steam locomotive for crack passenger service, especially in areas where the grades are kept to a minimum. It can pull several cars at very high speeds, or moderate sized trains at good speed. Don't waste it pulling slow or bulk freight.

6/6 GE Class Crocodile: These electric locomotives were first put in service on the Swiss Rhaetian Railway, serving ski resorts in the Alps. Electricity was chosen because of the easy access to hydroelectric power and the lack of coal in Switzerland. The first crocodile, so named for their engine hoods, entered service in 1921 and proved much more powerful and reliable than the steam locomotives that were previously employed. The design was so successful that it was embodied in larger locomotives for parts of the Swiss Federated Railways. As a tribute to their soundness, the entire class of these locomotives was still working in 1987 with the exception of the first built which was destroyed in an avalanche.



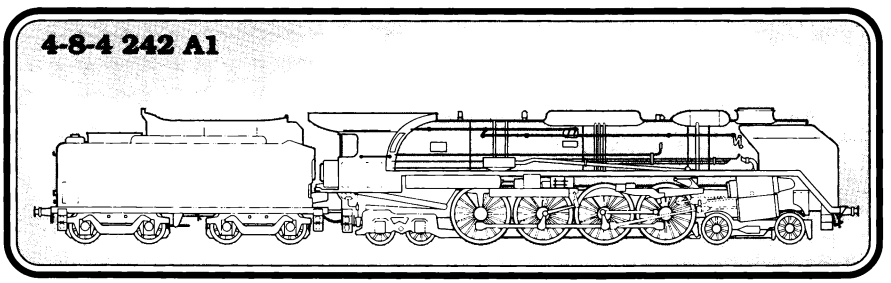
This locomotive is very useful for moderate freight trains, especially those needing to negotiate steep grades. It is too slow for passenger service, but its low maintenance costs make it an attractive replacement for aging steam freight locomotives.



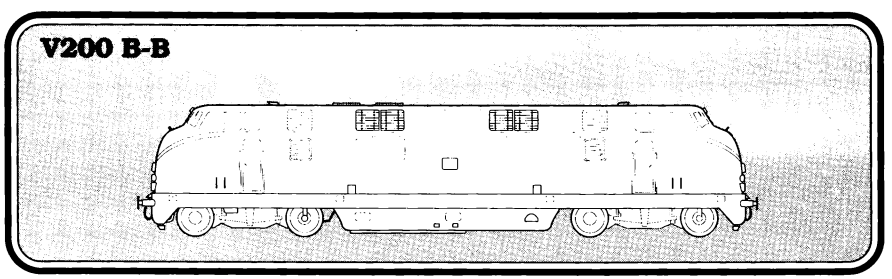
1-Do-1 Class E18: This electric express passenger locomotive entered service on the growing electrified network of the Deutsch Reichsbahn in 1935, and was the result of 9 years of evolution from earlier designs. The design was characterized by the four independent drive wheels within a rigid frame, guided at both ends by single trucks. They proved to be very fast and powerful, the most advanced electric locomotive in the world at the time, and 92 were ordered. However, the war intervened and only 53 were built. Two of the locomotives were in Austria at the end of the war and retained there. The Austrians copied the design, and for many years they were the fastest passenger locomotives in that country.

Use these locomotives to replace any aging steam locomotive in passenger service except possibly the A4. Like the diesels, all electric locomotives offer substantial savings in maintenance costs.

4-8-4 242 A1: Rebuilt in 1946 from a pre-war 4-8-2, this was the most powerful steam locomotive to run in Europe, and the most powerful locomotive of any type outside of North America. It was designed by Andre Chapelon after the 4-8-2 from which it originated proved a failure and an embarrassment to the government committee that had designed it. The A1 developed 5,500 hp compared to 2,800 before rebuilding, and was similar in output to an American 4-8-4 which weighed 50% more. At a time when French railway brass were trying to convince the government to finance an expensive conversion to electric operation, the A1 proved an even greater embarrassment than it had as a failure in its previous life. It was more powerful than any existing electric locomotive and was sufficiently economical in coal consumption to nullify the savings of electrification. Unfortunately, the bureaucrats won out, and the only example of this superb locomotive was quietly broken up in 1960.



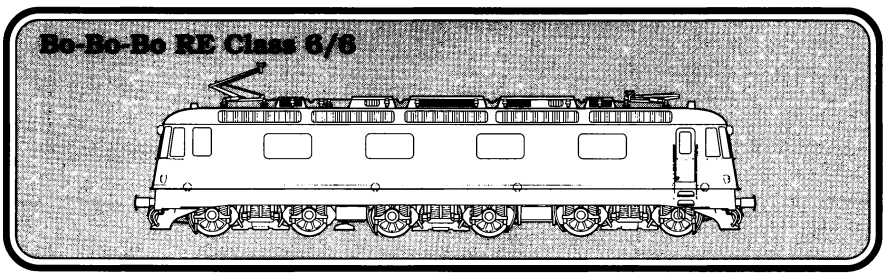
When this locomotive becomes available it is a good choice for powering your longest and heaviest freight trains, as well as your longer fast trains. Its pulling power can make up for its maintenance cost.



V200 B-B: These 1,100 hp diesel-hydraulic passenger locomotives were built as prototypes in 1953 for the German Federated Railway and went into production 3 years later. A diesel-hydraulic locomotive transmits its power directly to the drive wheels, not to

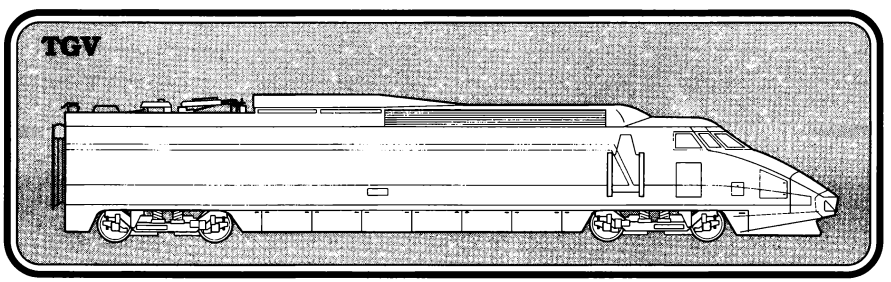
electric traction motors as in a diesel-electric. They were designed for use on those parts of the railway that were not scheduled for electrification. By 1962 these locomotives were averaging 145,000 miles per year of service, pulling loads 30% higher than originally specified for the design. In the 1980's the number in service has been reduced due to further electrification.

This locomotive is useful for pulling shorter trains, especially those carrying mail or passengers. However, don't ask this engine to perform in mountainous areas, it works best in the plains of central and northern Europe.



Bo-Bo-Bo RE Class 6/6: This heavy duty mixed traffic mountain locomotive entered service in 1972 on the difficult Swiss Federated Railway's St. Gothard mainline over the Alps. It provides an astounding 10,000 hp in a single unit, and was built to help cope with the steadily increasing tonnage moving over this route since the 1950's. The RE 6/6 developed from earlier designs stretching back to the 1930's, and are over 80% more powerful than their immediate precedents, the Ae 6/6, within the same weight limitations. In addition to being capable of all freight traffic, they are also suited for trains moving at the highest speeds allowed on the Swiss system.

This is the locomotive for powering all heavy freight and passenger trains, especially in mountainous regions of the map. Its huge horsepower output means it can handle any load over any grade.

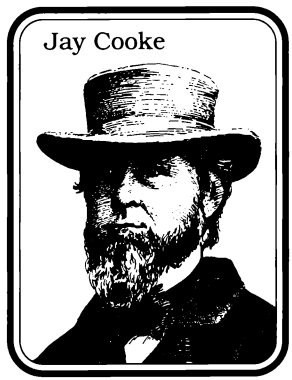


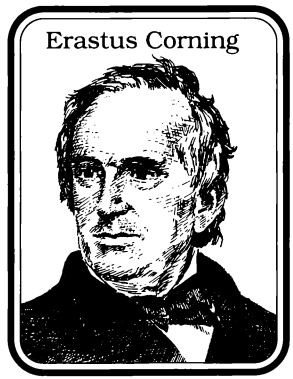
TGV: The French TGV (*Train a Grande Vitesse*, literally "train with great speed") is a high speed articulated multiple unit electric train placed in service in 1981 between Lyons and Marseilles.

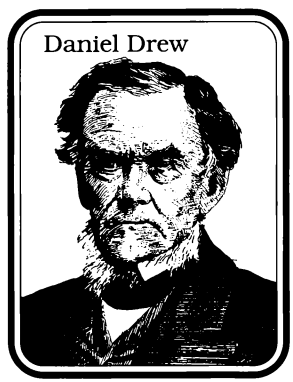
The route between these two cities and on to Paris is the busiest in France and the TGV trains were intended to reduce congestion. Although the maximum speed for these trains is now limited to 168 mph, they have reached 236 mph, a world record. Each train consists of eight cars and two power units, one at each end. The train remains together as a unit. Most of the existing trains have first and second class accommodations, though a few are for first class or mail only. The special track on which they run has now been extended to Paris.

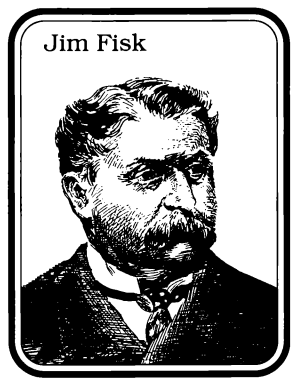
Employ this locomotive on your fast trains, primarily mail and passenger. No locomotive in the game is capable of its speed. Heavier freight loads slow down the train dramatically, so leave those chores to the RE 6/6.

Tycoon Biographies
North American Tycoons


Jay Cooke


Erastus Corning


Daniel Drew

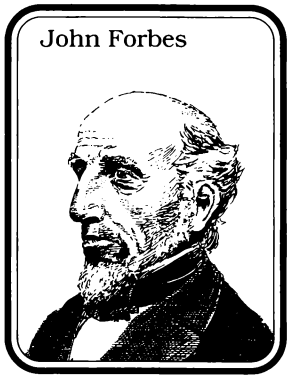

Jim Fisk

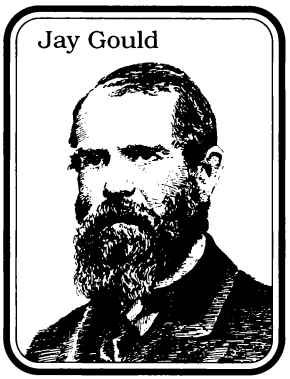
The following historical figures may appear in a game of Railroad Tycoon as the president of a competing railroads. The management style of competing railroad presidents can be expected to reflect the personality of these tycoons. One set of tycoons appear in games in North America, and another set appear in games in England or Europe.

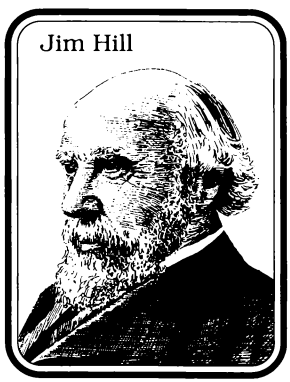
After the name of each tycoon is a letter in parantheses, either a "B", "R", or "M". A "B" indicates a builder, a man you can expect to concentrate on building the best railroad he can. An "R" indicates a robber baron, a man you can expect to be very active in the stock market. An "M" indicates a mixed personality, a man capable of both building and stock manipulation, but not particularly adept at either.

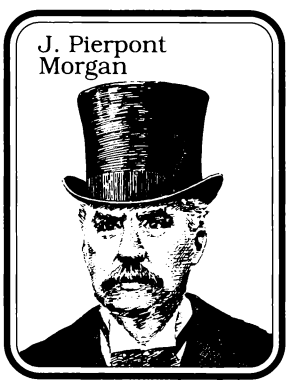
Jay Cooke (M): Made a fortune during the Civil War selling Union war bonds that the government had been unable to move. In 1869 his firm, Jay Cooke & Company, undertook the financing of the Northern Pacific Railroad. Despite Cooke's good intentions and an early strong start in raising funds, the railroad stalled. Construction costs had soared and funds had dried up. Unable to pay his debts or interest on Northern Pacific bonds, Cooke's banking house closed, precipitating the Panic of 1873.

Erastus Corning (M): A nailmaker and ironmonger, as Mayor of Albany he rode behind the Dewitt Clinton, the first locomotive and train to run on of the Mohawk & Hudson Railroad. He served for 20 years as president of the Utica & Schenectady, drawing no salary, but made a fortune supplying everything the railroad needed in the way









of iron. He formed the New York Central in 1853 by combining several small railroads linking Albany to Buffalo. Outmaneuvered by Cornelius Vanderbilt, he lost control of the NYC in 1867.

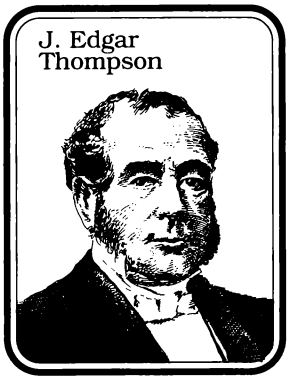
Daniel Drew (R): Called the King of the Bears for his Wall Street short selling attacks, or bear raids. ("He that sells what isn't his'n, must buy it back or go to prison.") Gained control of the Erie Railroad in the Panic of 1857 and looted it ruthlessly with the help of Jay Gould and Jim Fisk who joined him after the Civil War. Was bankrupted by Gould after Drew left the Erie in 1868 and tried to raid it once more.

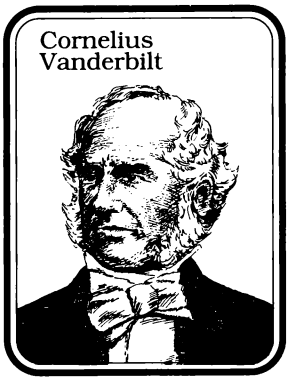
Jim Fisk (R): A Vermont tin peddler, carnival sharpie, and stockbroker brought into the Erie Ring by Dan Drew to help with stock manipulations and speculations. With Jay Gould he attempted to corner the gold market in 1869. Gould forced him out of the Erie in 1872 because of criminal charges and scandals. He was shot by the boyfriend of his former mistress.

John Forbes (B): Made his fortune as a young man with clipper ships in the China trade, and was persuaded to lead a group taking over the failing Michigan Central Railroad. He built it into Chicago, and turned his eyes farther westward. He bought the tiny Aurora Branch Railroad and eventually built it into the Chicago, Burlington, & Quincy. Praised by Ralph Waldo Emerson for his remarkable force, modesty, and goodness, uncommon traits in the railroad men of the era.

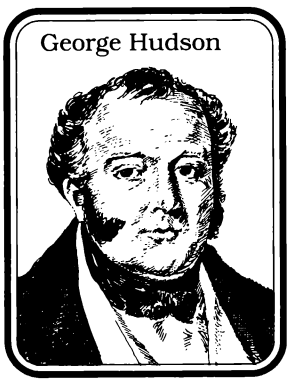
Jay Gould (R): The shrewdest Robber Baron. Brought into the Erie Ring by Dan Drew, he directed the looting of the railroad as president from 1868 to 1872. He manipulated the stocks of several

other railroads thereafter, and cheaply bought control of the scandal-plagued Union Pacific with funds looted from the Erie. He paid out large dividends and drove the UP stock to astounding prices, at which point he sold out. The new owners found a huge secret debt and unpaid interest due. He went on to buy up and manipulate the stock of several other railroads including the Missouri Pacific, the Texas & Pacific, and the Wabash. Died rich at his estate in Lyndhurst, New Jersey in 1892.

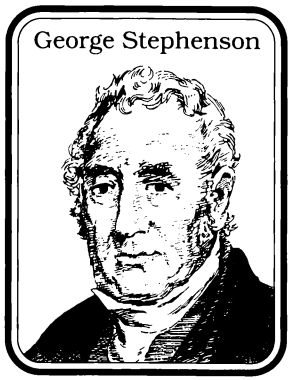


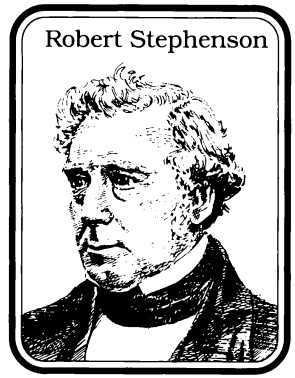


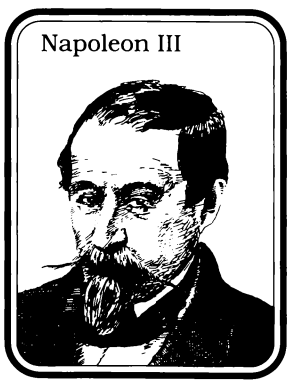
Jim Hill (B): The greatest American railroad entrepreneur, he built the Great Northern from Duluth to Seattle without the government assistance claimed necessary by the other trans-Mississippi trunk lines. The Great Northern was the only transcontinental railroad built without land grants, and the only one not to go into receivership. Hill built and operated his road well and actively helped the settlers along it. He later proved an adept financier, taking over the failing Northern Pacific and the CB&Q to gain a link to Chicago. He was ruthless and tough when he had to be.



J. Pierpont Morgan (R): The pre-eminent banker and financier of the late 1800's and early 1900's. He was an active force in consolidating and reorganizing railroads such as the Philadelphia & Reading, Chesapeake & Ohio, Erie, Norfolk & Western, Southern, and others. He helped Vanderbilt take over the New York Central, financed other railroad ventures, and eventually began running them himself, often placing a deputy in charge to keep his ownership secret. His ultimate dream of combining all US railroads into a cooperative cartel to reduce ruinous competition was squashed by the anti-trust campaigns of President Teddy Roosevelt.







J. Edgar Thompson (B): The man who made the Pennsylvania Railroad the best in the country, consistently outmaneuvering his rivals while setting and meeting the highest standards for engineering and efficiency. It was said that his power was so great that the state legislature would delay its adjournment until he had no more business for it to conduct.

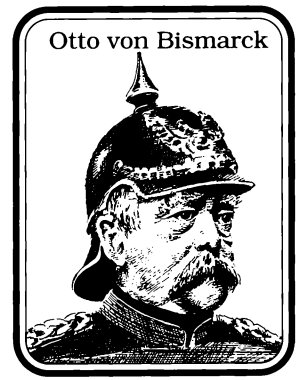
Cornelius Vanderbilt (M): The "Commodore" made his fortune in shipping but sold out to get into railroads in 1857. After gaining control of the New York & Harlem Railroad and the Hudson River Line, he bitterly fought for and captured the New York Central. Combining these lines he eventually extended the NYC to Chicago. He furiously battled the Erie Ring and later fought the Pennsylvania Railroad until J. P. Morgan brought peace. At his peak he was the richest man in America.

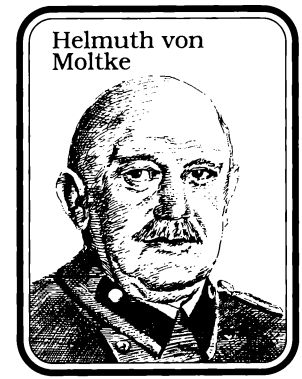
European Tycoons

Isambard Kingdom Brunel (B): One of the most noted Victorian engineers, he was famous for the bridges and ships he built, including the colossal *Great Eastern*, an enormous iron ship and a wonder of the age. He was appointed engineer of the Great Western Railway at the age of 27 in 1833 and built it to the unprecedented gauge of 7 feet. His innovative and graceful engineering works, plus his exacting standards, made the Great Western and its subsidiaries the most efficient and smooth riding railroad in England. Great Western trains averaged 50 mph in comfort long before most other railroads could dream of such speed.

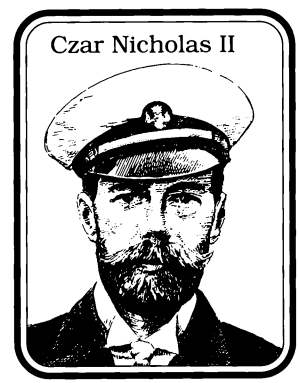
George Hudson (R): Known as the "Railway King", he was a draper in York who invested an inheritance in railway shares and thereafter became active in railroad affairs. In 1837 he was appointed

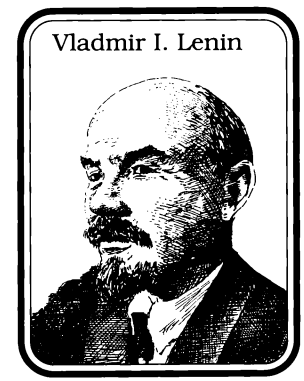
chairman of the York & North Midland Railway, and later was instrumental in the formation of the Midland Railway, becoming its chairman. His ambition was to unite all the railways of England under his control. He manipulated and schemed without principle, and at his peak controlled nearly one third of the track in use. His efforts helped trigger the Railway Mania of 1845 that swamped Parliament with worthless and fraudulent railway schemes. His financial collapse ended the mania.


Otto von Bismarck


Helmuth von Moltke

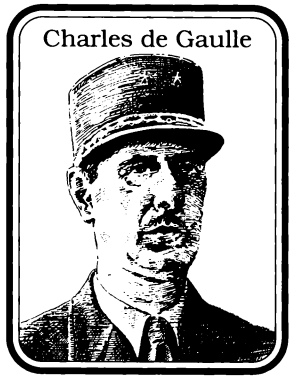
George Stephenson (B): A coal mine enginewright who went on to develop and demonstrate to the world a practical steam locomotive. He built some of the most famous English railways, including the Stockton & Darlington and the Liverpool & Manchester, and founded with his son the famous Robert Stephenson & Company locomotive works in Newcastle upon Tyne.


Czar Nicholas II


Vladmir I. Lenin

Robert Stephenson (B): The son and co-worker of George Stephenson, and a brilliant engineer in his own right. He worked with his father in the design and construction of the first practical steam locomotives, and operated their locomotive works that supplied the first engines to many parts of the world. He was appointed engineer of the London & Birmingham Railway, completing it in 1838, and went on to build many lasting and famous engineering works.

Napoleon III (M): This self-style "Emperor" loved expansion for the sake of glory, even if it incurred large debts. He promoted railway expansion by a law that guaranteed railroad bonds. In addition to weak financial thinking, Napoleon III was unable to manage complex problems. This eventually caused the ignominious callapse of his "empire".


Charles de Gaulle


Baron Rothschild

Benito Mussolini (M): This fascist leader of Italy (1922-45) was Hitler's "model". Despite his many faults, Mussolini was said to have "made the trains run on time". However, his nepotistic bureacracy was actually quite inept. Worse, a crushing debt load and a world-wide depression destroyed all attempts at Italian economic expansion.

Otto von Bismarck (R): "Iron" Chancellor to the King (Kaiser) of Prussia, Bismarck unified Germany by forcing smaller neighbors to submit, through politics or war, as appropriate. Competent in finance and administration, he waited for sufficient strength or a golden opportunity before forcing a "unification."

Helmuth von Moltke (B): As Chief of the German General Staff, 1900-14, Moltke was a great planner and administrator. His detailed orders for railroads to mobilize and maneuver troops were very successful. He believed that a good attack may be the best defense.

Czar Nicholas II (B): Last of his line, Nicholas was a weak and hesitant leader. Railroading progressed well when he had good advisors (such as the genius Serge Witte, who organized the vast Trans-Siberian line).

Vladimir I. Lenin (M): Architect of the soviet governmental system, Lenin was a bold, gambling leader who returned to Russia in a "sealed train". He took over a weak, confused nation and started its rapid industrial expansion (during the 1920s and 30s).

Charles de Gaulle (B): French head-of-state after WWII, he was concerned with growth and glory first, but unlike Napoleon III, de Gaulle had greater skill in administration and problem-solving. He vigorously defended all "French" possessions, but avoided overreaching expansion.

Baron Rothschild (R): One of the greatest banking houses in Europe, the Rothschilds were financiers of many railroads. Ruthlessly efficient, they bankrupted failures as quickly as they supported successes. Like most bankers, they disliked open warfare or conflict. Money and size were their chief weapons.

DESIGNER'S NOTES

The final product of any computer game project is determined by the strength of the central game concept, the ability and tastes of the designers, and the trial and error process of the game's evolution. Provided here is a brief description of how these elements were brought together to design Railroad Tycoon.

The Railroad Tycoon design team consisted of Sid Meier, Bruce Shelley, and Max Remington, all working at MPS Labs, the software design studio of MicroProse Software.

For Sid, Railroad Tycoon was most memorable as a game unlike any other he has made in his career. Knowing trains were "cool", he was challenged by the task of building them into a fun and interesting game. Bruce had worked on railroad games in a previous life, including the **1830** game mentioned below, and has had a longtime interest in railroad history. For him, Railroad Tycoon was the most interesting game project of a ten year career in games. Max joined the team after the basic mechanics were proved sound and jumped in with his normal unending stream of ideas and artwork. Inspired to build his own model railroad at home, he lived up to his nickname, "Maximum".

The inspiration for Railroad Tycoon came from several sources. One was playing **1830**, a boardgame about US railroads, during after hours gaming sessions here at MicroProse. Then Sid worked up a system for building and operating model railroads that looked like something right out of a model railroading magazine. In the Spring 1989 Bruce wrote a proposal for a railroad game based on his experience with railroad boardgames, his interest in railroad history, and the play of the innovative new "sandbox" or "god" computer games that had recently appeared.

The railroad game idea kicked around for some time, until in a burst of activity during a vacation in August of 1989, Sid built the first working prototype. This game was crude, but the potential was clearly there. A project underway at that time was put on hold and development of Railroad Tycoon went full-time.

A central design problem was choosing the scope of the game. Sid's early game was a model railroading game. Bruce's proposal posed the player as the president and guiding force of a railroad, but

it left out the tycoon competition so popular in **1830**. The dilemma was how much to include in one game.

In the end we automated much of the low end detail, such as throwing individual track switches, and concentrated on the higher end, you as president of your own railroad. We found that running a big railroad and having to fight off rivals made the most interesting game.

We didn't forget train operations, however, and stretched the game to allow for that to be included. By having one day of train operations represent the operation of your entire railroad for two years, we retained the feel of day to day train operations within the framework of running a big railroad.

By this decision we hope to have retained the appeal to real rail enthusiasts, while broadening the appeal to game players. We gained the evolution of locomotives and other technology, the changing of the game worlds as time passes, the influence of your railroad on the growth of cities, and competition over time with competing railroads. The more tedious details of train operation, not remembered as fun now anyway, are left for lower level managers on your "staff".

The keys to making the details of train operation fun and challenging were the routing of trains by station, the different economies for each world, and the competition with rivals over territory and stations.

Trains were previously routed by you acting as a switchman, setting switches to allow certain types and classes of trains to pass in one direction or another. The new system gives more of the feel of you being the dispatcher, planning the movement of trains and then letting them run. This system was one of the big breakthroughs in making the game work.

The next big change was increasing the complexity of the original economy in which just five types of cargo existed: mail, passenger, fast freight, slow freight, and bulk. Now the whole map became important as you scanned for industrial sites and resources. The more complex arrangement of supply, demand, and conversion of cargos added a new dimension to play.

The last major addition was the competing railroads. Before their inclusion, the game was just a puzzle, or a race to accumulate cash. Now players had some real worries: rate wars, stock takeovers, and being beaten into rich areas. In addition, they had some new opportunities: takeovers resulting in more cash or an ally against another rival.

The game originally was built for the Northeast USA, but we talked ourselves into expanding into England first, where railroading started, and then the Western USA and Europe. By making each world different in some manner, we hope that each has its own flavor and interest.

Giving the game as much variety as we could was one of our goals from the start. We think that the endless variation of the maps, the four different worlds, and the influence of your railroad on regional economic growth insure that no two games can be alike. In our experience no two games, nor any two people, play similarly, and different styles of play can succeed. We believe there is room for detailed operation, wide expansion, and financial wheeling and dealing as you wish.

The player is the master of his own destiny. Each time you start a new game, you don't know how the game is going to go.

We are very happy with the result of our work. Railroad Tycoon was a great project to work on, and we're not just talking about field trips to the Strasburg Railroad and the B&O Museum. We think we got just about everything in that we wished for, and even as we wind down from many months of intense work it remains a joy to play.

We hope that Railroad Tycoon is as interesting, challenging, and fun to play as it was to design.

Sid Meier
Bruce Shelley
Max Remington
March 2, 1990

Player's Notes

For new player's it is recommended that the reality levels all be set at the easy options. With more experience add the Complex Economy, then Dispatcher Operation, and finally Cut-Throat Competition.

The most important part of building a new railroad is selecting an area of the world to start in. One option that often works well is to start your railroad between areas containing one or more cities each, 20 squares or less apart. Two areas such as this should be able to provide passenger traffic capable of generating substantial revenue right away. Then look to expand your mainline to other cities and extend branch lines to industries or resource areas.

Also important when first starting out are the locations of industries and sites that generate the supply of cargos besides passengers and mail. Having a harbor on your line is very useful because in all worlds they demand at least some cargos, and in others they generate the supply of cargos as well.

Concentrations of natural resource sites are useful because they tend to grow in size with utilization. If you can get trains into a large natural resource area, it can pay to put on several large unit trains just to haul this resource.

Also look for industry connections, such as those found in the tutorial railroad where coal is converted to steel and then into goods. You can then set up train routes like the one in the tutorial where one train carries all of the conversions, earning revenue on each delivery. Use Wait Until Full Orders to make such conversion trains more efficient by running full.

When planning your track, minimize grades and curves, avoid 90 degree curves, and minimize bridges. These track features all have their uses, but they also slow your trains and sometimes limit what you can do.

Double track where several trains are normally scheduled to use the same sections, but use signal towers as much as possible to increase speed rather than double track. Where to double track and where to place signals should be determined by how much traffic is moving past and how much cash you have to spend.

The longer the distance between stations and the faster the trains that are running, the longer the distance you can afford between

signals. If you break blocks at track switches with signal towers, you can prevent long blocks consisting of both mainline and branch line track.

Signal towers at both ends of a bridge may be useful if the bridge washes out. You can then override the signals to Hold, and prevent trains from wrecking.

Try not to get into a negative cash position, but also keep your outstanding bonds down. However, there may be times when the opportunity to expand or the purchase of new facilities or equipment can justify taking on a heavy debt. Refinance your bonds during boom times.

Don't necessarily replace all of your locomotives just because a new model has become available. You must balance the cost of replacing a locomotive versus savings in maintenance costs and improved performance. Often an older design is more efficient at performing a task than a newer engine. When playing in the Northeastern USA or England, it usually pays to replace your Grasshoppers or Planets on better class trains as soon as you can afford to.

If you have stations generating several carloads of mail each year, the high cost of improving them with post offices may pay, if you can put on trains carrying mail to take advantage of this supply. Use the other storage facilities as well to minimize the wastage of cargos and keep your trains as full as possible. For example, goods storage at USA harbors is helpful if you are carrying off the goods. Restaurants are usually a good investment for any station where passenger deliveries are made, but reserve hotels for the busier passenger stations.

Because the time taken to switch on new cars at a consist change applies against the next movement of a train, the cost of a switching yards may be a good investment at stations where higher class cargos are being put on. The yard can help speed the cargo on its way and eventually repay your investment in higher revenues for deliveries.

Keeping all of your trains adequately maintained reduces your maintenance costs but may require many strategically placed engine and maintenance shops. The decision of when to replace locomotives depends on their maintenance cost and the availability of better

engines. You'll have to decide at what point would the lower maintenance cost of a newer engine repay its cost.

When just getting started or building expansions, it may pay to freeze or slow time while you build. Adding new stations in January of the year and having trains ready to run to them can maximize the first year revenue bonus for deliveries to new stations.

Plan your rate wars carefully, if possible, and try to win them quickly. They can be useful in blocking your competition and reducing his stock price, but are usually very costly to put in effect. The reduced revenue at a rate war station continues until the war is resolved.

Adjust the length and consist of your trains to best suit the job they are to do. Shorter trains normally move faster, but for slow and bulk freight its more important to move quantity, regardless of speed or distance. Also keep the car types the same or within one class in each direction. Where trains are running empty in one direction, the return trip may be faster with just a caboose on the train instead of empty cars.

Buy your own stock when it's cheap, or when you can afford it. Remember that you can't be thrown out of office if 50% of the stock is in the treasury. Carefully consider local offers to buy more stock that may occur when you build into new cities. The cash may help, but diluting the stock makes it more difficult to raise the price. Buy the stock of your competitors, when you can afford it, as this at least forces them to buy as well. Take over competitors if you have the opportunity. This greatly improves your situation.

As time passes, it is harder to keep up profits. To do so you will probably need fast trains carrying mail, passengers, and fast freight over long distances, or a great deal of slow and bulk freight deliveries.

Further Reading

A wide variety of sources were consulted for this game. No single source discusses locomotive specifications, railroad history, or railroad operations, especially for Europe as well as North America. Among the many books used, the following were found especially useful and are recommended for further reading:

The American Heritage History of Railroads in America, by Oliver Jensen, American Heritage Publishing, New York, 1975. An excellent and well illustrated history of American railroading.

Aboard a Steam Locomotive, a sketchbook, by Huck Scarry, Prentice-Hall, New York, 1987. A children's book, but nevertheless a well illustrated and simple explanation of how railroads and steam locomotives work.

Early American Locomotives, by John H. White, Jr., Dover Publications, New York, 1972. A collection of locomotive engravings from early railroad literature.

Cade's Locomotive Guide, by Dennis Lovett and Leslie Wood, Marwain, Bletchley, 1988. A guide for modeler's of British locomotives, but includes useful information and photos.

This Fascinating Railroad Business, by Robert Selph Henry, Third Edition, Revised, The Bobbs-Merrill Company, New York, 1946. Includes a variety of interesting details about the history of constructing and operating railroads until the time of its being published.

The Great Book Of Trains, by Brian Hollingsworth and Arthur Cook, Portland House, Crown Publishers, New York, 1987. A major source of locomotive information. Includes some beautiful illustrations.

The Guinness Railway Book, by John Marshall, Guinness, Enfield, 1989. Interesting railroad facts, records, and trivia.

A History Of The American Locomotive, Its Development 1830-1880, by John H. White, Jr., Johns Hopkins Press, Baltimore 1968, and Dover Publications, New York, 1979. Design influences, component development, and case histories of early locomotives in America; not for beginners.

A History Of The Baltimore And Ohio Railroad, by John F. Stover, Purdue University Press, West Lafayette, 1987. An excellent history of the pioneering American road known as the "railroad university."

How To Operate Your Model Railroad, by Bruce A. Chubb, Kalmbach Books, Milwaukee, 1978. An entertaining and understandable discussion of railroad operations as explained for model railroaders.

Impossible Challenge, by Herbert H. Harwood, Jr., Barnard, Roberts, and Company, Baltimore, 1979. A history of the Baltimore & Ohio Railroad within the State of Maryland.

The Lore Of The Train, by C. Hamilton Ellis, Crescent Books, New York, 1975. An entertaining, though wordy, world history of railroading.

The Railroad - What It Is, What It Does, by John H. Armstrong, Revised Edition, Simmons-Boardman, Omaha, 1982. The best source found for what American railroads are like today and how they are operated.

The Railway Revolution, by L. T. C. Holt, St. Martin's Press, New York, 1962. A very interesting biography of George and Robert Stephenson, two of the most famous design and construction engineers of English railroading.

Steam Locomotives, by Luciano Greggio, Crescent Books, New York, 1985. An excellent source for locomotive illustrations and information on the historical development of locomotives throughout the world.

Track Planning For Realistic Operation, by John Armstrong, Second Edition, Kalmbach Books, Milwaukee, 1979. Although directed at model railroaders, this paperback succinctly discusses and illustrates railroad operations.

The World's Rail Way, J. G. Pangborn, Bramhall House, New York, 1974, a facsimile of the 1894 edition. A beautifully illustrated and descriptive narration of the history of railroading prior to the 1893 Columbian Exposition. The author helped organize the railroad exhibit there and this book resulted from the material he gathered.

CREDITS

Original Game Design
Sid Meier with Bruce C. Shelley

Original IBM Programming
Sid Meier

Original IBM Computer Graphics
Max Remington III

Original IBM Sound & Music Programming
Ken Lagace & Jim McConkey

Original IBM Music Composition
Jeffery L. Briggs

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Bruce C. Shelley

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Technical Illustrations by Michael Reis,
George Gill, with Iris Idokogi
Screen Shot Illustrations by Cheryl Glover
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Photography Props courtesy of the
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