

SPONSORING AND SUPPORTING
RAILROAD MERIT BADGE
IN CONJUNCTION WITH
BOY SCOUTS OF AMERICA

THE RAIL INDUSTRY IS ONE OF THE OLDEST INDUSTRIES IN THE UNITED STATES; IT LITERALLY "UNITED" THE EAST AND WEST, AS WELL AS THE NORTH AND SOUTH. THE RAIL INDUSTRY REMAINS A VITAL PART OF OUR NATION'S ECONOMY, PROVIDING UNIQUE SERVICES AND JOB OPPORTUNITIES.

NAME:

PATROL:

TROOP#:

RAILROADING MERIT BADGE REQUIREMENTS
REVISED EFFECTIVE JANUARY 1, 2005

- 1.a. Draw to scale the layout of your own model railroad or one that could be built in your home. Have point-to-point or loop with different routings. Include (one of the following) a turnaround, a terminal, or a yard and
- 1.b. Name the scale and track gauge for four model railroad gauges. Show the correct way to clean and lubricate model train equipment.
- 2.a. Explain how real electric and diesel locomotives develop power.
- 2.b. Identify by model or picture six different kinds of railroad cars.
- 2.c. Show two basic signals used either by color or configuration. Explain the meaning of five whistle signals. Describe an emergency way to signal a train to stop.
- 3.a. Name four departments of a railroad company. Describe what each does.
- 4.a. Explain six rules of safety to use aboard trains; on platforms; and around bridges, yards, and tunnels.
- 4.b. Explain the use and function of the "EOTD" or "FRED" now used in place of cabooses.
5. Explain the use of a timetable by making a written plan for a trip by rail between two cities at least 500 miles apart. List the times of departure and of arrival at your destination, the number of the train, and the service you want.
- 6.b. View a video showing the operation of a railroad such as the Burlington Northern and Santa Fe and American Association of Railroads' video prepared for the 1997 National Jamboree.
7. Name three types of modern freight trains and explain why they are more efficient than mixed freights.

STATION 13

Track Maintenance

This station will provide the scouts information on track maintenance and allow them an opportunity to swing a spike maul.

STATION 14

Service Project

While not specifically part of the Railroading Merit Badge, each scout needs to perform service projects in order to

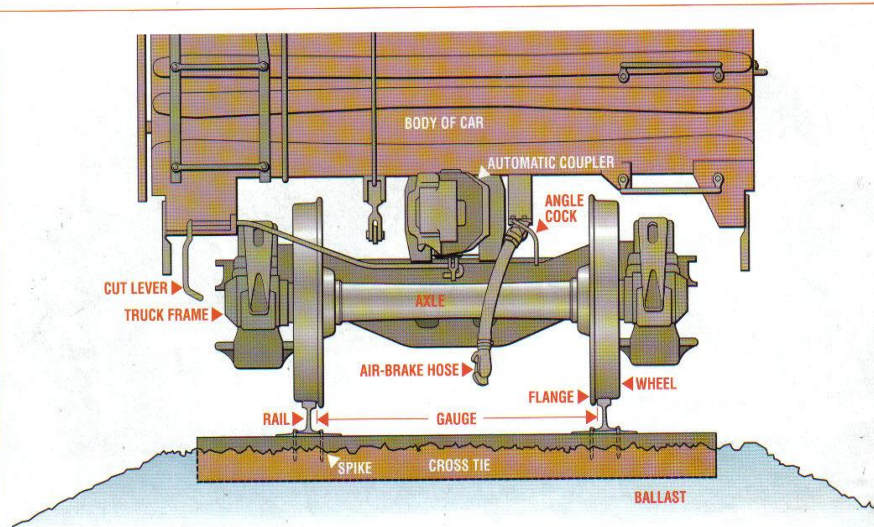
To earn a credit for a service project, and to donate to the White Water Valley Railroad, we are providing the labor of washing the windows and sweeping up the 7 operational coaches.

The tools of railroading

RAILROADS ARE FIXED-GUIDEWAY SYSTEMS for transporting goods or people. Their basis is the low friction, and hence high efficiency, of a hard wheel rolling on a hard surface. They are made up of many elements: people doing different jobs, and hardware for them to use. The jobs range from laborer to strategic planner. The tools can be as simple as pieces of wood and steel fastened together, or as sophisticated as computerized dispatching systems. The technology is both ancient and modern—its basics

have changed little in 150 years, yet some elements are spin-offs of space exploration.

The two features that set railroads apart from other modes of transportation—and make them so appealing to so many people—are their rolling stock (locomotives and cars) and their roadway (track). By examining the diagram below of the end of a freight car on a standard section of track, one can learn a lot about the most important tools of railroading.



AUTOMATIC COUPLER: Couplers work as clasped hands. A movable knuckle locks in place automatically when two cars come together. Uncoupling is accomplished by manual operation of the cut lever, which unlocks the knuckle, allowing it to open as the cars are separated. Other, fully automatic, designs are used on captive equipment such as fleets of commuter cars.

ANGLE COCK: In the open position, allows brake-pipe air to flow from car to car; when closed (as on the end of a train), keeps air in system.

AIR-BRAKE HOSE: Brakes work by air pressure. Cars are linked by hoses to each other and the locomotive, whose air compressor maintains pressure in the brake pipe, or train line. To set brakes, the engineer reduces pressure in the line, causing a valve on each car to draw air from a reservoir, increasing pressure in the car's brake cylinder. As the cylinder's piston moves, linkages force brake shoes against the car's wheels. The system is nearly fail-safe, if it is fully charged at the start of a run—any event causing a loss of pressure in the line causes the brakes to apply.

WHEEL: Each pair of wheels, connected by an axle, is called a wheelset. With few exceptions, cars have eight wheels, grouped in two sets of four in swiveling assemblies called trucks. Bearings on outer ends of axles are connected to truck frames.

FLANGE: A key element of railway technology—a small lip on inner edge of the wheel which keeps rolling stock on the rails. Flange depth is only about 1 in.

TRACK: Straight (called tangent) or curved. Curvature of track is measured in degrees: most mainline curves are 1 or 2 degrees; track in rough terrain can have

10 degree curves or sharper. Slope, or grade, of track is measured as a percentage of distance climbed per distance traveled forward: a 1 percent grade is a significant challenge to a heavy train; grades steeper than 3 percent are very rare.

RAIL: Made of high-quality steel. Three parts: head, web, base. Measured by weight per yard: most mainline rail is in 130- to 140-lb. range; some light-duty track has much lighter rail. Standard rail length was once 39 feet, with sections joined by bolts and angle, or joint, bars. Jointed rail still makes up most track, but the standard now is continuous welded rail. Joined into 1500-foot lengths at special plants, CWR is transported to the field, where even more joints are welded after it is laid.

GAUGE: The distance between the inner faces of the rail heads is 4 feet 8½ inches—standard gauge. Used throughout North America and Europe, it originated in England and matches the spacing of ancient wagon wheels. Variations from standard (rare in the U.S. and Canada) are termed either narrow gauge or broad gauge.

SPIKE: Four or six per tie (three or four for each rail, more on curves), driven through tie plates into cross tie to secure rail in place. Clips and special tie plates are used increasingly with wood ties, and always with concrete ties.

CROSS TIE: Most ties are of treated wood, though concrete is gaining favor because of its greater strength and durability. Spacing varies according to traffic: closer for heavy traffic, farther for light use.

BALLAST: Crushed rock to keep track in horizontal and vertical alignment and properly drained. Laid over gravel sub-ballast and earth sub-grade.

STATION ONE Requirement 6.

View a video showing the operation of a railroad such as the Burlington Northern and Santa Fe and American Association of Railroads video prepared for the 1997 National Jamboree.

STATION TWO Requirement 7a

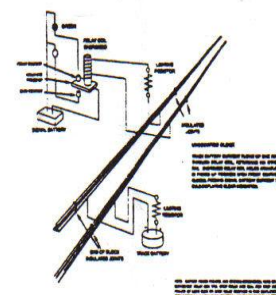
Show two basic signals used either by color or configuration. In order for signals to work the track circuit must indicate if a train is present.

Example 1. Shows a track circuit with no train present in the "block".

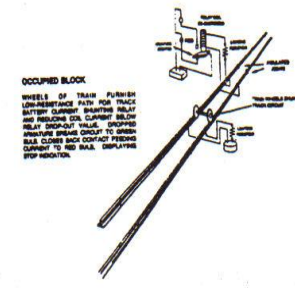
Example 2. Shows a track circuit with a train in the "block".

Example 3. Shows a three light signal mast.

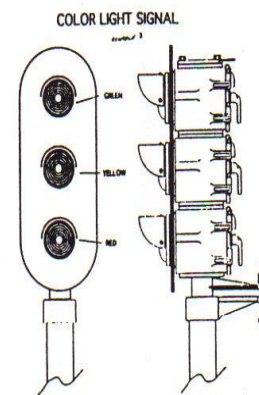
Example 4. Shows a searchlight signal and how it works.



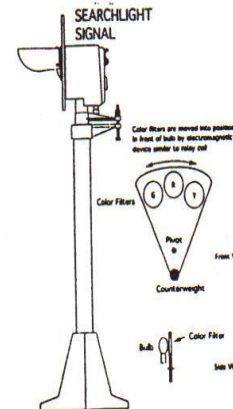
EXAMPLE 1



EXAMPLE 2



EXAMPLE 3



EXAMPLE 4

7.b. Explain the meaning of five whistle (horn) signals.

Whistle signals are used to warn people about the presence of a train. They were also used prior to the introduction of hand-held two-way radios to communicate with other trains and railroad employees. When radio communication fails, whistle (horn) signals are used as backup.

ENGINE WHISTLE (HORN) "O" IS SHORT "—" IS A LONG BLAST	MEANING
O	Apply brakes. Stop.
OO	Engineer's answer to any signal not otherwise provided for.
OOO	When standing, back.
OOO	When running, stop at next station.
Succession of short sounds.	Alarm for persons or livestock on the track.
————	Approaching stations, junctions, and railroad crossings at grade.
—OO	A second section is following.
—OOO	Flag man protect rear of train.
---	Release brakes. Proceed.
--- O---	Approaching public crossing at grade.
-----	Flag man may return from west to south*.
-----	Flag man may return from east or north*.
-----	*These whistle signals are followed by one (O), or two (OO), or three (OOO) short sounds when several tracks are in use.

3.a. Name four departments of a railroad company. Describe what each does.

Railroad Departments:

1. Marketing: Sells freight services to the shippers.
2. Finance and Accounting: Keeps track of revenue and expenses. Raises funds for improvements.
3. Law: Handles legal matters for the railroad.
4. Information Systems: Designs and maintains computer systems that provide needed information for the railroad and its customers.
5. Human Resources: Hires, trains, and provides employee benefit programs.
6. Executive: Bears responsibility for the successful operation of the railroad.
7. Operations: Runs and controls the trains.
8. Communications and Signals: Provides communication systems and maintains the signals that control train movements.

Other departments include Public Relations, Purchasing, and Mechanical.

STATION 11
Requirement

7.d.

Explain the use and function of the "EOTD" (End Of Train Device) or "FRED" (Flashing Rear End Device) now used in place of cabooses.

The "EOTD" and "FRED" are devices that attach to the coupler and brake system on the last car. They transmit air pressure measurements to a monitor in the locomotive cab. If trouble is discovered the engineer can stop the train. The engineer can also apply the brakes at the end of the train through this device preventing the train from "running away" on a down grade. At night the "EOTD" has a flashing red or yellow stobe to warn other engineers that a train is ahead.

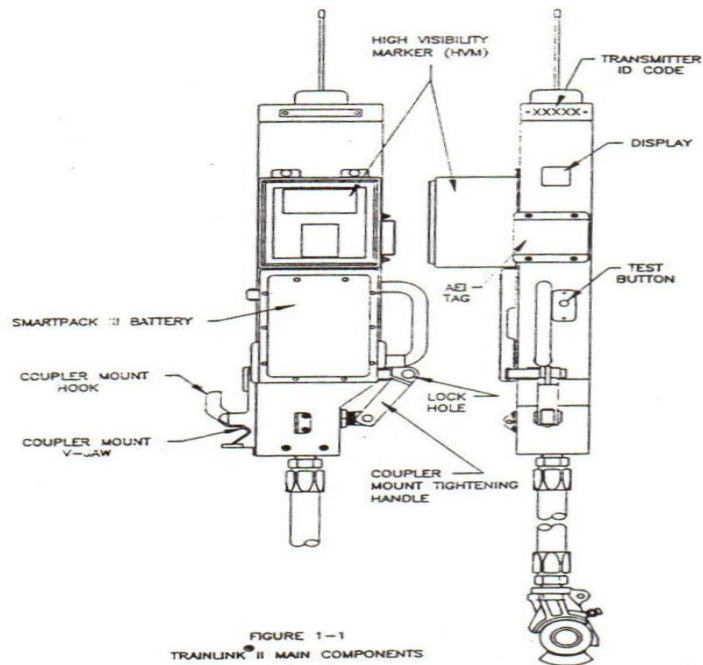


FIGURE 1-1
TRAINLINK II MAIN COMPONENTS
EOTD - End Of Train Device

STATION TWO - continued
Requirement 7.c.

Describe an emergency way to signal a train to stop.

The chart below describes hand signals once used to communicate with the train engineer. Today hand-held two-way radios make hand signaling rare, but it may be used if radios fail. Item "g" in the chart is required knowledge for the railroading merit badge. To stop a train, you might need to signal from a location up to a mile from the point where the train actually stops.

HAND SIGNALS	
MANNER OF USING	INDICATION
(a) Swung horizontally at right angle to the track.	Stop
(b) Slight horizontal movement at arm's length.	Reduce speed
(c) Raised and lowered vertically.	Proceed
(d) Swung vertically in a circle at right angle to the track.	Back
(e) Swung horizontally.	Apply air brakes
(f) Held at arm's length above the head.	Release air brakes
(g) Any object waved violently by anyone on or near the track.	Stop

STATION THREE
Requirement 1.d.

Explain how real electric and diesel locomotives develop power.

Electric motors turn the wheels that make them go. Inside a modern locomotive, diesel engines of up to 6,000 horse power turn a large alternator that provides electricity to "traction motors" geared to the wheels. Most traction motors are DC, but newer units have AC motors that are more powerful and easier to maintain. Electric locomotives obtain power from overhead lines or from an outside third rail.

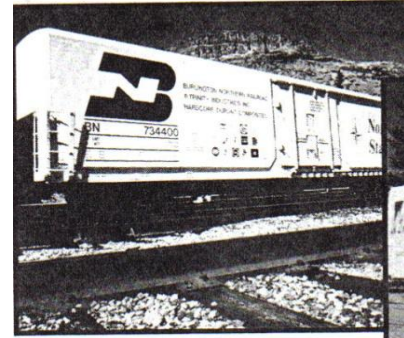


STATION 3 - continued

1.d. Explain the terms; Dynamic Braking and Radial Steering trucks

STATION 4

1.d. This station allows the scouts to get into the cab of a locomotive. The presenter will explain the controls and other points of interest in the cab of the locomotive. NOTE: No horn blowing.



← 7 - EQUIPPED BOX CAR -
Trinity Industries Inc. Railcar Division



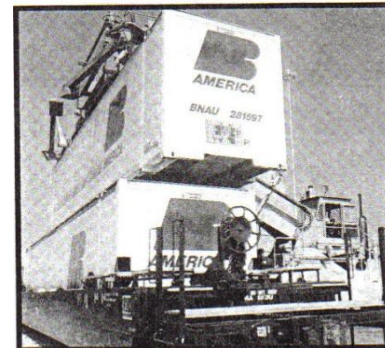
8 - REFRIGERATOR CAR - Gunderson Inc.



9 - GONDOLA CAR - Gunderson Inc.



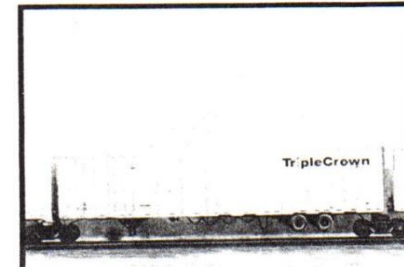
10 - COILED-STEEL CAR -
Thrall Car Manufacturing Co.



11 - STACK CAR - Gunderson Inc.

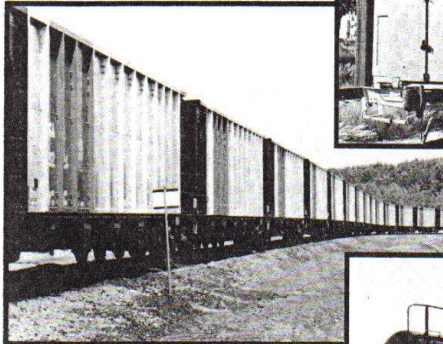
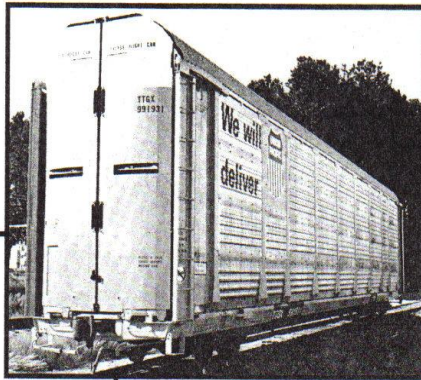


12 - SPINE CAR -
Trinity Industries Inc. Railcar Division



← 13 - ROADRAILER CAR - Wabash National

1 - AUTO RACK - Thrall Car Manufacturing Co. →



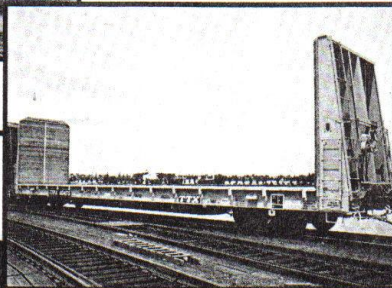
2 - OPEN TOP HOPPER-COAL CAR - Trinity Industries Inc. Railcar Division



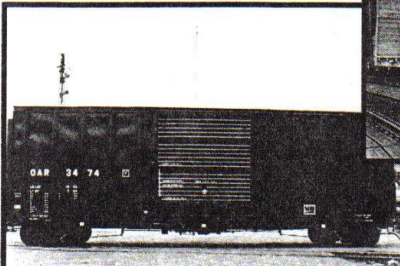
3 - TANK CAR - Trinity Industries Inc. Railcar Division



4 - COVERED HOPPER - Thrall Car Manufacturing Co.



5 - FLAT CAR - Gunderson Inc.



← 6 - PLAIN BOX CAR - Trinity Industries Inc. Railcar Division

The power of railroading

LOCOMOTIVES are railroading's most potent and popular symbols. The major types that have been used in North America are steam (now confined to museums, tourist lines, and the occasional excursion), diesel-electric (the standard of the industry), and straight electric (always a tiny minority).

Steam locomotives burn coal, oil, or (in early days) wood in a firebox at the rear of the boiler. The hot gases from the fire pass forward through tubes called flues inside the boiler, which is nearly filled with water. The gases heat the water, turning it to steam, which collects in the steam dome. By opening the throttle, the engineer admits the steam to the dry pipe, which takes it to the two valve chests (one each side). Moving back and forth according to the engineer's setting of the valve gear with the "reverse lever," the valves admit steam to the cylinders at times when it can push the pistons as it expands. The piston rods are linked to main rods, which are linked to side rods, which are attached to the driving wheels. After the steam has done its work, it is exhausted into the smokebox and out the smokestack, pulling the hot, smoky gases from the flues with it in the familiar *chuff-chuff* cadence.

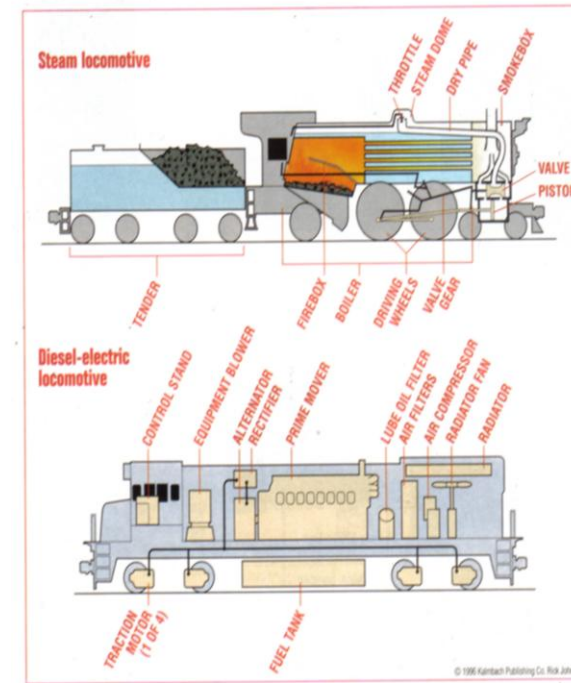
There were many configurations, or wheel arrangements, for steam locomotives [see table]. The engine in our diagram has 4 leading wheels, 4 driving wheels, and 2 trailing wheels—a 4-4-2. The majority of engines with no leading wheels were switchers, those with two hauled freight, and those with four hauled passenger trains. Before steam succumbed to the superior efficiency and

lower costs of diesels, the major locomotive builders were Baldwin, American (Alco), Lima, and several railroads themselves.

Diesel-electric locomotives have a large diesel engine, or prime mover, which turns an alternator to produce electricity. The alternating current is then rectified to direct current and fed to axle-mounted electric traction motors geared to the wheels. Older units have generators that produce D.C. directly; the latest models have inverters that change D.C. back to A.C. for use in new types of traction motors, a major advance. Much of the space inside a diesel locomotive's hood is occupied by auxiliary items such as the equipment blower and radiator assembly.

Diesel (and electric) wheel arrangements are expressed in terms of axles, not wheels. "A" indicates a single powered axle, "B" means 2 together, "C" is 3, etc. Nonpowered axles are indicated as numbers. A handful of old A1A-A1A units remain, but virtually every locomotive today has all axes powered and is either a B-B (two 2-axle trucks, as in the diagram) or C-C (two 3-axle trucks). Today's major diesel builders are General Motors' Electro-Motive Division (EMD) and General Electric. In the past, Alco, Baldwin, and Fairbanks-Morse also made diesels, and some are still at work.

Electric locomotives generally draw current from overhead wires via roof-mounted pantographs, modify it, and use it in their traction motors. They share many advantages with diesels, but are not as flexible because they can't operate beyond the wires, and so are mostly confined to niches where traffic density is high.



Common steam locomotive designs

Wheel arrangement	Name or type
0-4-0	
0-6-0	
0-8-0	
2-6-0	Mogul
2-6-2	Prairie
2-8-0	Consolidation
2-8-2	Mikado
2-8-4	Berkshire
2-10-0	Decapod
2-10-2	Santa Fe
2-10-4	Texas
2-6-2	
2-6-4	
2-8-2	
2-8-4	Yellowstone
4-4-0	American
4-4-2	Atlantic
4-6-0	Ten-Wheeler
4-6-2	Pacific
4-6-4	Hudson
4-8-2	Mountain
4-8-4	Northern
4-6-4	Challenger
4-8-2	Cab-forward
4-8-4	Big Boy

Notes: A listing such as 0-6-0T is used to indicate a tank engine, a locomotive which carries its own fuel and water supply, with no tender. Some railroads had their own names for certain wheel arrangements, particularly the 4-8-4, which had several names (Pocahontas, Dixie, etc.).

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STATION 5

- 5.a. List five safety precautions that help make trains safer for workers and passengers.
- 5.c. List ten safety tips to remember when you are near a railroad track (either on the ground or a platform) or aboard a train.
- 5.d. Explain the guidelines for conduct when you are near or on railroad property and explain the dangers of trespassing on railroad property.

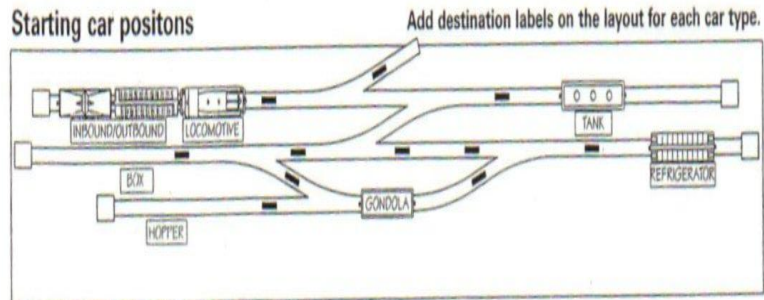
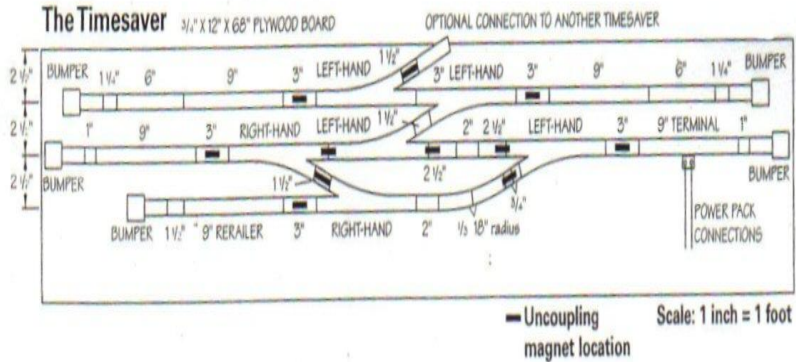
STATION 10
Requirement

- 1.c. Name three types of modern freight trains and explain why they are more efficient than mixed freights.
Grain trains, intermodal trains, and coal trains are three types of modern freight trains. Modern freight trains are more efficient than mixed freight trains because they do not require switching at each division point. The trains are loaded at one place or terminal usually with one type of commodity for the same destination. They stop briefly for refueling and crew changes. The trains are then returned to the same shipper to be filled with the same commodity and do not require cleaning. This reduces cost to the shipper for rail service.

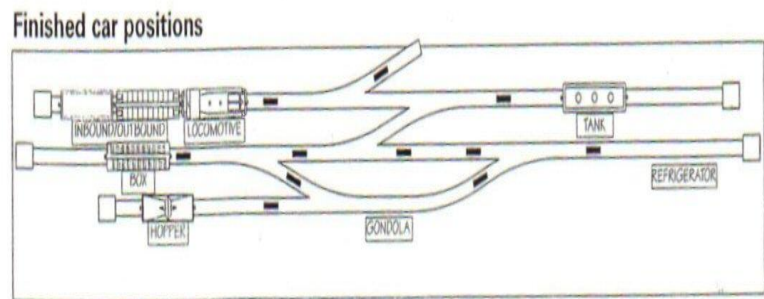
Explain the use of a timetable by making a written plan for a trip by rail between two cities at least 500 miles apart. List the times of departure and arrival at your destination, the number of the train, and the service you want.

AMTRAK

Most railroads wanted out of the passenger business in the 1960's and welcomed the federal government's formation of AMTRAK to carry passengers. Most of our nation's young people have never ridden a train. In order to understand train travel, it is necessary to read a timetable. The sample timetable is for Train 19 and 20, The Crescent. Train 19 is a daily train departing New York City at 2:45 P.M. Since the train originates in New York, it is referenced as mile post 0. If the train is on time, it will arrive in Washington D.C. at 7:15 P.M. A passenger travels 223 miles between New York and Washington D.C. If a passenger travels from New York to New Orleans, he would arrive at 8:00 P.M. the following day having traveled 1,378 miles. According to the schedule for Train 19 and 20, a passenger may choose from the following services: coach, standard bedroom, or deluxe bedroom. Standard and deluxe bedroom accommodations include complimentary meals and other amenities.



Three cars at labeled destinations.
Two cars are marked with tags for removal.



What is the train number back to New York? _____

What is the name of the train? _____

If you leave New Orleans on Saturday, what day will you arrive in New York? _____

What time will you arrive at Penn Station? _____

If you are in a sleeping car, what can you eat in the diner without paying? _____

Extra Credit: How many Train 19's will Train 20 pass between New Orleans and New York City? _____

There are 2 Crescent trains.

12. 20

Train 19 Crescent:
 Departs New York--Penn Station, New York daily

City	Mile	Time*	Connections
New York--Penn Station, New York (NYP)	0	2:45 pm ET	-
Newark, New Jersey (NWK)	9	3:03 pm ET	-
Trenton, New Jersey (TRE)	57	3:41 pm ET	-
Philadelphia, Pennsylvania (PHL)	90	4:40 pm ET	-
Wilmington, Delaware (WIL)	115	5:02 pm ET	-
Baltimore, Maryland (BAL)	183	5:54 pm ET	-
Washington, D.C. (WAS)	223	7:15 pm ET	-
Alexandria, Virginia (ALX)	231	7:34 pm ET	-
Manassas, Virginia (MSS)	256	8:08 pm ET	-
Culpeper, Virginia (CLP)	291	8:41 pm ET	-
Charlottesville, Virginia (CVS)	335	9:37 pm ET	-
Lynchburg, Virginia (LYH)	396	10:45 pm ET 10:55 pm ET	-
Danville, Virginia (DAN)	459	11:59 pm ET	-
Greensboro, North Carolina (GRO)	510	1:20 am ET 1:40 am ET	-
High Point, North Carolina (HPT)	522	1:56 am ET	-
Salisbury, North Carolina (SAL)	556	2:38 am ET	-
Charlotte, North Carolina (CLT)	599	3:37 am ET	-
Gastonia, North Carolina (GAS)	623	4:04 am ET	-
Spartanburg, South Carolina (SPB)	676	5:05 am ET	-
Greenville, South Carolina (GRV)	707	5:55 am ET 6:10 am ET	-
Clemson, South Carolina (CSN)	737	6:47 am ET	-
Toccoa, Georgia (TCA)	770	7:23 am ET	-
Gainesville, Georgia (GNS)	808	8:05 am ET	-
Atlanta, Georgia (ATL)	856	9:05 am ET 9:25 am ET	
Anniston, Alabama (AIN)	958	10:47 am CT	-
Birmingham, Alabama (BHM)	1022	12:23 pm CT 12:43 pm CT	-
Tuscaloosa, Alabama (TCL)	1077	1:53 pm CT	-
Meridian, Mississippi (MEI)	1174	3:37 pm CT 3:40 pm CT	-
Laurel, Mississippi (LAU)	1230	4:38 pm CT	-
Hattiesburg, Mississippi (HBG)	1259	5:09 pm CT	-
Picayune, Mississippi (PIC)	1323	6:12 pm CT	-
Slidell, Louisiana (SDL)	1341	6:35 pm CT	-
New Orleans, Louisiana (NOL)	1378	8:00 pm CT	1. 58. 58/7. 58/7. 58/27

* When time is red, train stops only to drop off passengers.
 When time is blue, train stops only to pick up passengers.

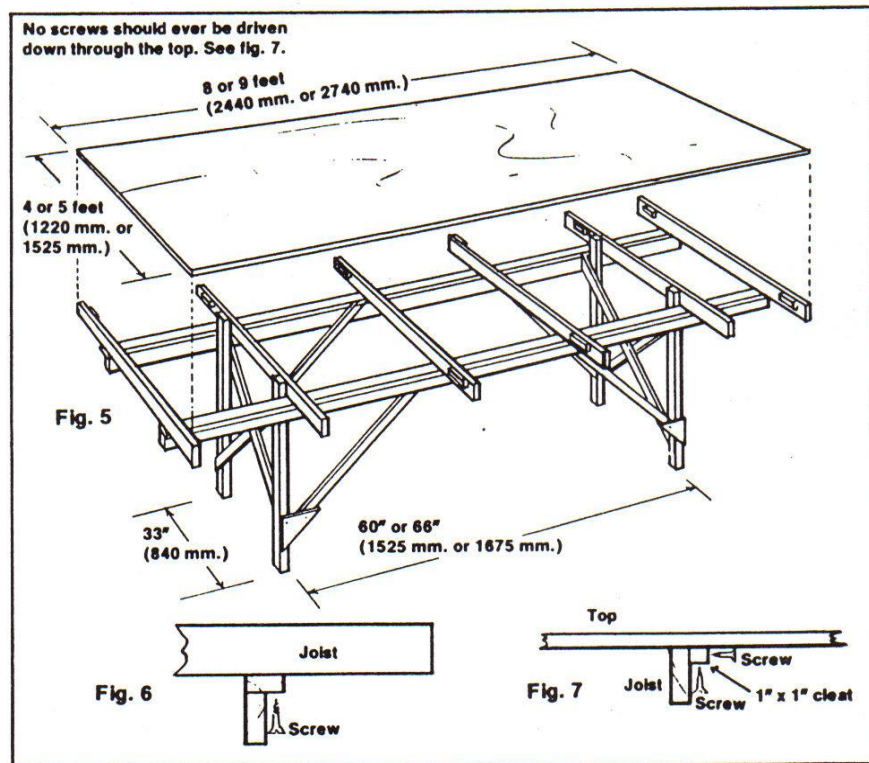
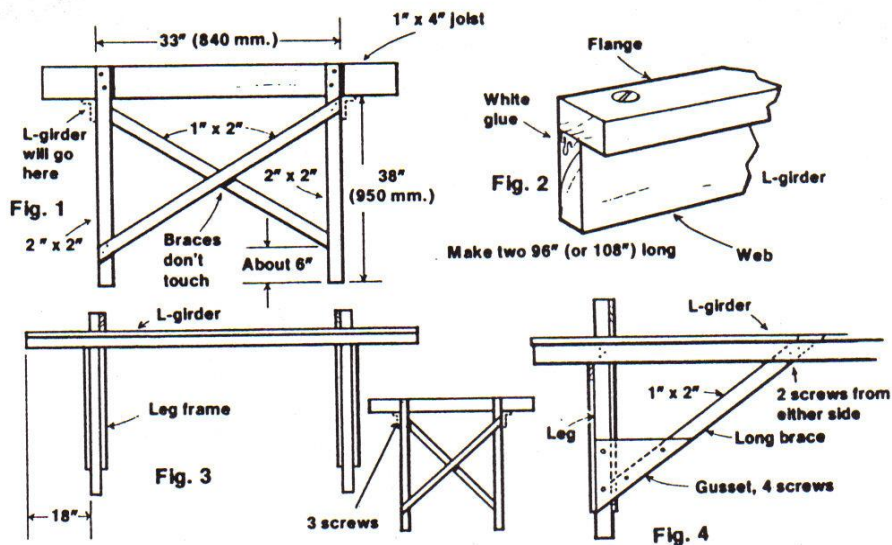
STATION 9
 The Timesaver

The timesaver is a switching game that tests your problem solving skills to see who can deliver all of the freight cars to their proper destinations in the shortest time. It is played on the standard HO layout shown in the drawing. Here is the list of the sectional track and other components it takes to build a timesaver using Atlas parts, which are widely available at hobby shops and online (only with your parent's assistance).

- 4 Atlas left-hand manual Snap-Switches
- 3 Atlas 9" straights
- 1 Atlas 9" terminal section
- 6 Atlas 3" straights
- 1 Atlas short section assortment
- 11 Kadee No. 321 uncoupling magnets
- 1 power pack
- 5 40-foot freight cars: boxcar, gondola, hopper, refrigerated boxcar, and tank
- 2 Atlas right-hand manual Snap-Switches
- 1 Atlas 9" railer
- 2 Atlas 6" straights
- 2 Atlas 1 1/2" straights
- 5 Atlas bumpers
- 1- 3/4" X 12" X 68" plywood board
- 1 diesel switcher (40-foot or smaller)

The game begins with the cars and locomotive positioned as shown in the diagram labeled "Starting car positions." Set the throttle to a slow speed and then use the power pack's reversing switch to change direction as you switch the cars. The game ends when all of the cars have been delivered to the positions shown in the diagram labeled "finished car positions." The elapsed time is your score and the best time wins.

Timesaver hint: *Think ahead and carefully plan your switching moves to avoid extra moves that take more time.*



Train 20 Crescent:
 Departs New Orleans, Louisiana daily

City	Mile	Time*	Connections
New Orleans, Louisiana (NOL)	0	7:00 am CT	-
Slidell, Louisiana (SDL)	37	7:55 am CT	-
Picayune, Mississippi (PIC)	55	8:16 am CT	-
Hattiesburg, Mississippi (HBG)	119	9:21 am CT	-
Laurel, Mississippi (LAU)	148	9:54 am CT	-
Meridian, Mississippi (MEI)	204	11:02 am CT 11:05 am CT	-
Tuscaloosa, Alabama (TCL)	301	12:38 pm CT	-
Birmingham, Alabama (BHM)	356	1:59 pm CT 2:09 pm CT	-
Anniston, Alabama (ATN)	420	3:42 pm CT	-
Atlanta, Georgia (ATL)	522	7:07 pm ET 7:46 pm ET	-
Gainesville, Georgia (GNS)	570	8:41 pm ET	-
Toccoa, Georgia (TCA)	608	9:22 pm ET	-
Clemson, South Carolina (CSN)	641	9:58 pm ET	-
Greenville, South Carolina (GRV)	671	10:45 pm ET 11:00 pm ET	-
Spartanburg, South Carolina (SPB)	702	11:41 pm ET	-
Gastonia, North Carolina (GAS)	755	12:41 am ET	-
Charlotte, North Carolina (CLT)	779	1:12 am ET	-
Salisbury, North Carolina (SAL)	822	1:58 am ET	-
High Point, North Carolina (HPT)	856	2:39 am ET	-
Greensboro, North Carolina (GRO)	868	3:07 am ET 3:27 am ET	666 , 80
Danville, Virginia (DAN)	919	4:29 am ET	-
Lynchburg, Virginia (LYH)	982	5:35 am ET 5:40 am ET	-
Charlottesville, Virginia (CVS)	1043	6:53 am ET	51
Culpeper, Virginia (CLP)	1087	7:45 am ET	-
Manassas, Virginia (MSS)	1122	8:19 am ET	-
Alexandria, Virginia (ALX)	1147	9:08 am ET	79
Washington, D.C. (WAS)	1155	9:33 am ET	142, 29/3, 174, 29, 51, 89, 91, 95, 97, 99
Baltimore, Maryland (BAL)	1195	10:40 am ET	-
Wilmington, Delaware (WIL)	1264	11:33 am ET	-
Philadelphia, Pennsylvania (PHL)	1292	midnight ET	41, 645, 651, 653, NJ 4615
Trenton, New Jersey (TRE)	1325	1:00 pm ET	-
Newark, New Jersey (NWK)	1373	1:48 pm ET	-
New York--Penn Station, New York (NYP)	1382	2:10 pm ET	142, 289, 293, 49, 63

* When time is red, train stops only to drop off passengers.
 When time is blue, train stops only to pick up passengers.

Top of page

Train number:

STATION 7
Requirement 4. a.

Trains deliver cars, building materials, clothes, etc. to all parts of the country. Highways often cross tracks. Public highway-rail crossings are the only safe place to walk or drive across the tracks. Public crossings are places specifically engineered for the highway to cross over the railway. So that you are able to identify them, public crossings are marked with signs, pavement markings and signals. Passive warning devices are signs and pavement markings that warn you to slow down, look, and listen for a train. Other signs that tell you that you must stop to look and listen for a train before crossing the tracks. Active warning devices are bells, lights, and gates; they tell you a train is coming. You must stop and wait until all trains have passed by before going through a public crossing. You must always yield to a train. The train always has the right of way, and

ANY TIME IS TRAIN TIME.

Always stay away from railroad rights-of-way so you do not risk being killed or injured by a train. If you are on railroad property without permission you are trespassing.

Never trespass by:

- ducking under or around lowered grade-crossing gates;
- taking shortcuts across tracks, train bridges, or trestles;
- walking on or near tracks, or hopping rides on trains;
- playing around train cars or locomotives;
- putting debris on tracks;
- or riding ATVs, snowmobiles, dirt bikes on right-of-way.

ALWAYS EXPECT A TRAIN

Constructing Your Layout

To ensure reliable operation when your layout is up and running, build it on a strong table and not on the floor. Dirt, lint, and dust can affect motors and track cleanliness on floor layouts, and accidents are more likely, too, as you are forced to step around the layout.

Many layouts begin on ½-inch-thick plywood fastened to a 1-by-4-inch framework (see page 11). Plywood thinner than ½ inch is not a wise choice since it is much more likely to sag between framing supports and will create problems with trackwork. Inclined grades for a scenic effect can be built by using a “cookie-cutter” approach where the plywood is cut to shape and installed on risers. However, a simple flat surface is recommended for your first layout.

Ready-to-use track comes in standard straight, curved, and flexible sections with switches, crossovers, etc. Such sectional track offers a lot of advantages for the first layout. If you change your mind, you can easily change your trackwork before fastening it to the plywood with scale spikes. White glue can be used for permanent fastening, but it is difficult to change later. Finely graded gravel (scale ballast) can be added to make your trackwork more realistic.

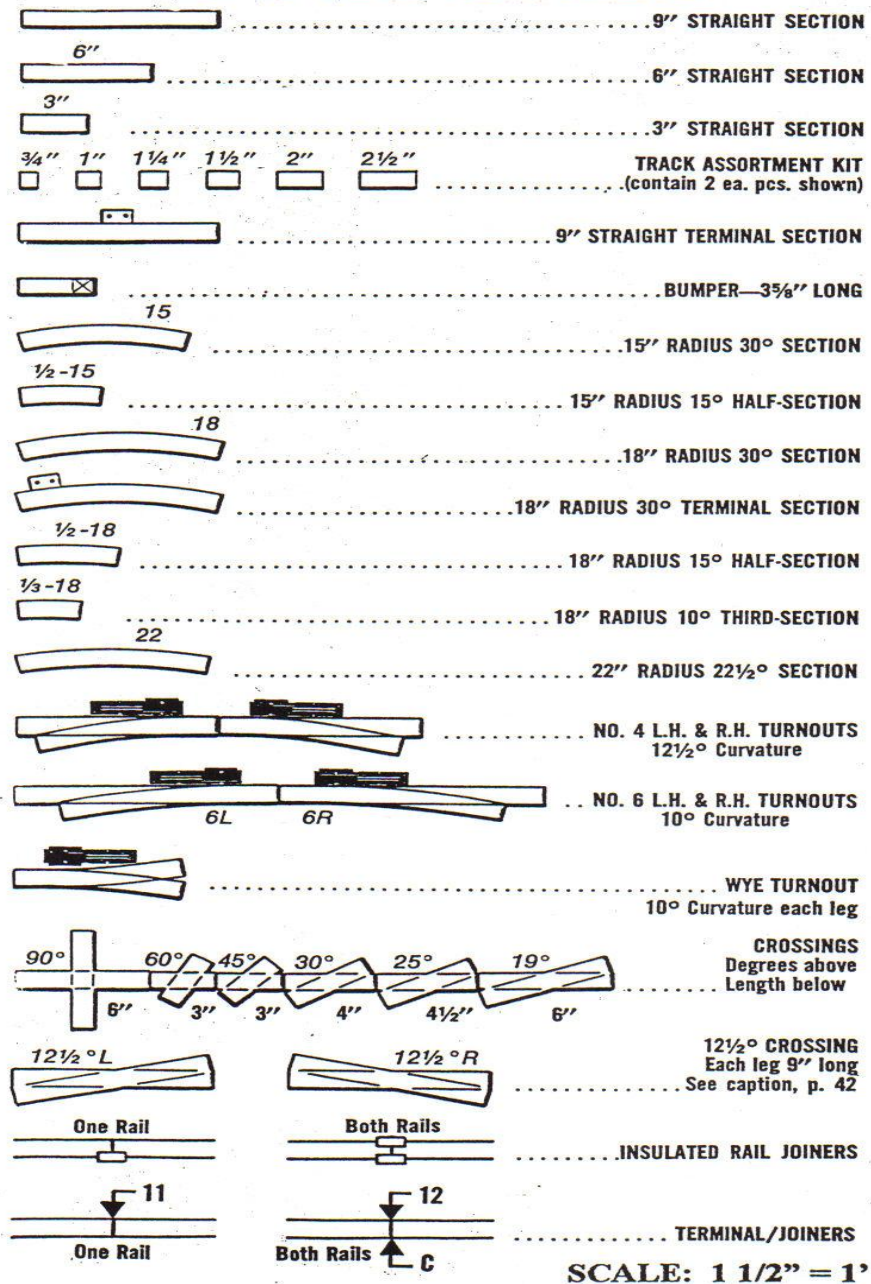
When you’ve tested every inch of trackwork, made sure that the joints are smooth and without kinks, and found no dip, humps, or jolts, you’ll probably feel pretty good about your layout. But you’ll probably also feel like the layout needs something more. It will look much more realistic and complete when scenery and structures have been added.

A good starting point is with easy-to-assemble, inexpensive building kits. Roads can be added, along with grass and other types of landscape features. Or you can create a more rolling landscape simply by using some crumpled newspapers, paper towels, and plaster.

- Tape crumpled newspapers to the plywood.
- Dip strips of paper towels in plaster and water and layer them over the newspapers.
- After the plaster sets, paint your landscape and add rocks and trees.

While there are many commercial model trees on the market, you also can make your own trees from dried weeds, twigs, or fibers from old furnace or air conditioner filter materials. Ground-up foam and dyed lichen are commercial products that also help complete scenery.

KEY TO TRACK PLAN SYMBOLS



OPERATION LIFESAVER SAFETY TIPS

Railroad tracks (right-of-way) are not safe places to be; they are intended only for trains. The land which extends out on both sides of the tracks is also part of the railroad right-of-way. As well as being dangerous, the right-of-way is private property. Each year, 3,000 people are killed or injured in collisions with trains. Be a live Scout rather than a tragic statistic.

Things you want to know about trains:

- A train is much wider than the tracks. It extends three feet beyond the rail on each side.
- A freight train of 100 cars traveling 55 mph takes more than a mile to stop.
- A freight train traveling 55 mph travels 81 feet each second.
- An optical illusion prevents you from accurately judging the speed and distance of a train that you see coming down the track.

The only safe way to be on railroad property is to buy a ticket and be a passenger. But even as a passenger, riding on trains requires being alert.

- Keep your body inside the car.
- Be careful when placing luggage or boxes in overhead racks.
- Wait until the train comes to a complete stop before getting on or off the train.
- Make sure you are in a seat when the train is starting up or coming to a stop.
- When moving through the train, use seat backs and handrails for support.
- Be sure to step over the gap between the train and the platform.

Requirement 8

8.a.(1) Draw to scale the layout of your own model railroad or one that could be built in your home. Have point-to-point or loop with different routings. Include (one of the following) a turnaround, a terminal, or a yard and a siding.

8.b.(3) Name the scale and track gauge for four popular model railroad gauges.

Identify the scales of four model cars or locomotives.

Turn in your test to the registration office located in the locomotive pavilion. You will be given a track planning template and tracing paper to complete Requirement 8.a.(1). When you complete the drawing, return it to the registration office (locomotive pavilion) to receive your Student Engineer's Card, which is your completed Railroading Merit Badge Card. You can also pick up a ticket for the switching contest and a chance to win an AMTRAK trip for a family of four and other prizes.

The smaller the size of the equipment, the larger the relationship to actual size. For example, in N gauge .075 inches equals one foot of the prototype. In G gauge, 3/8 inch equals one foot of the prototype. The gauges we will work with are:

(Small)	N gauge-scale .075 in - 1/160 (1 inch = 160 inches) gauge 9.0mm
(Medium)	HO gauge-scale 3.5mm-1/87 (1 inch=87 inches) gauge 16.5mm
(Large)	O gauge-scale 1/4 inch -1/48 (1 inch=48 inches) gauge 1.250 inch
(Giant)	G gauge-scale 3/8 inch-1/32 (1 inch=32 inches) gauge 1.766 inch

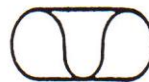
LAYOUTS



Oval with return cutoff.
favoring clockwise operation



Folded dog bone
(More folds are possible.)



Ovals with two return cutoffs.
favoring either direction



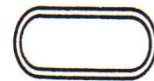
Return loops



Figure eight



Out and back with
stub terminal



Two-track (or double-track)
oval



Oval



Water wings



Dog bone



Point to point with
stub terminals



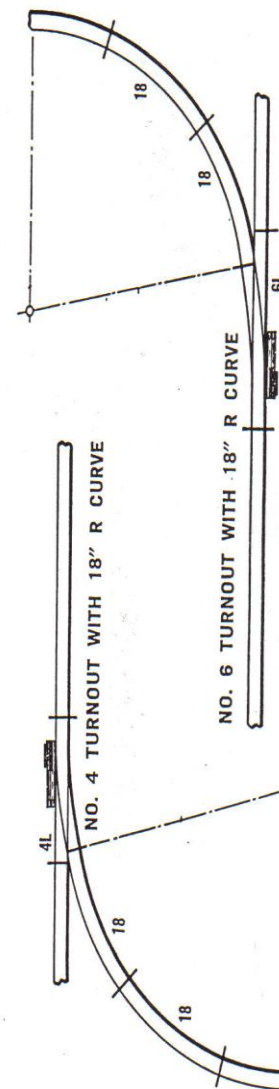
Loop to loop



Point to loop



Two-lap oval



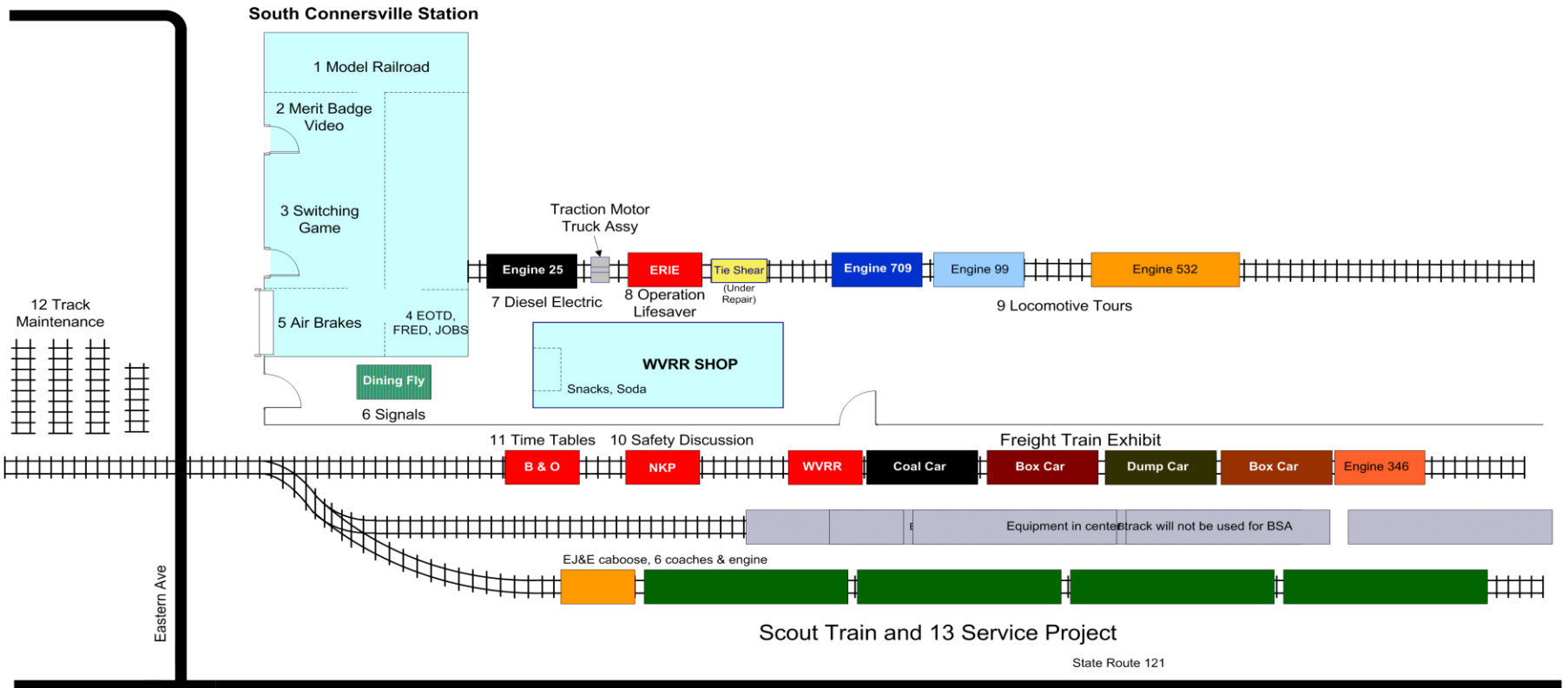
MODEL RAILROAD
INDUSTRY ASSOCIATION



15. Who was it built for?
16. Locate car #759.
 - a. What was it?
 - b. What railroad did it work for?
 - c. What motto was used by the railroad?
17. Locate the orange caboose.
18. Locate the equipment with #99.
 - a. What is it?
 - b. What company did it work for?
 - c. Where was this company located?
19. What is the name of the WVRR Connorsville Depot?
20. Locate the switching tower.
 - What is the name of this building?
 - What city did this building once stand?
21. Find car #C-2129. What railroad does it represent?
22. The railroad was preceded by what other type of transportation along this particular route?
23. Locate the yellow dump truck. What is special about this piece of maintenance equipment?
24. What is the white marker with a number on it along the railroad track represent?
25. Locate the locomotive with the cab in the center. How does the crew know which end is the front?

KIMS GAME

1. Look for the picture of the Pennsylvania Steam Locomotive
 - a. What is the engine number?
 - b. What is the class number for this locomotive?
 - c. How much fuel can this locomotive carry?
 - d. What kind of fuel does this locomotive use?
 - e. What is the total weight of the locomotive and the tender?
 - f. Besides fuel, what else must the tender carry in order for the crew to operate this locomotive?
2. What is used for insulation in passenger coach #5 from the period of 1840-1920?
3. An untreated railroad tie's life expectancy is?
4. A treated railroad tie's life expectancy is?
5. Who manufactured locomotive #25 that is in the museum's collection?
6. What type of locomotive is #25?
7. How many cabooses are in the railroad's collection?
8. Name four railroads.
9. Find the equipment with #6435.
 - a. What is it?
 - b. What railroad does it represent?
 - c. What was its original number?
10. Find the picture of a 1200HP Lima-Hamilton locomotive.
 - a. Is it steam or diesel?
 - b. Where was this locomotive used?
 - c. What colors is it painted?
 - d. What year does this unique paint scheme represent?
11. Locate the gasoline driven locomotive. What is the manufacturer's name?
12. Where is the golden spike located?
13. What is the number of New York Central locomotive?
14. Find the picture of the cab forward type freight locomotive. What is its class?



NOTE: Location of Engines and Cars may change