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.

3.b. Explain the use and function of the "EOTD" or "FRED" now used in place of cabooses.

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.a. 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.

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 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.

Name three types of modern freight trains and explain why they are more efficient than mixed freights.
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 different people doing different jobs, and hard work for them to use. The jobs range from labor 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.

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.

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.

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.
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.

<table>
<thead>
<tr>
<th>ENGINE WHISTLE (HORN)</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;O&quot; IS SHORT</td>
<td>Apply brakes. Stop.</td>
</tr>
<tr>
<td>&quot;-&quot; IS A LONG BLAST</td>
<td>Engineer's answer to any signal not otherwise provided for.</td>
</tr>
<tr>
<td>0</td>
<td>When standing, back.</td>
</tr>
<tr>
<td>OO</td>
<td>When running, stop at next station.</td>
</tr>
<tr>
<td>OOO</td>
<td>Alarm for persons or livestock on the track.</td>
</tr>
<tr>
<td>OOO</td>
<td>Approaching stations, junctions, and railroad crossings at grade.</td>
</tr>
<tr>
<td></td>
<td>A second section is following.</td>
</tr>
<tr>
<td>Succession of short sounds.</td>
<td>Flag man protect rear of train.</td>
</tr>
<tr>
<td>-OO</td>
<td>Release brakes. Proceed.</td>
</tr>
<tr>
<td>-OOO</td>
<td>Approaching public crossing at grade.</td>
</tr>
<tr>
<td>-</td>
<td>Flag man may return from west to south*.</td>
</tr>
<tr>
<td>-O-</td>
<td>Flag man may return from east or north*.</td>
</tr>
<tr>
<td>- - - -</td>
<td>* These whistle signals are followed by one (O), or two (OO), or three (OOO) short sounds when several tracks are in use.</td>
</tr>
</tbody>
</table>

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.


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.
7.d. **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.

<table>
<thead>
<tr>
<th>HAND SIGNALS</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Swung horizontally at right angle to the track.</td>
<td>Stop</td>
</tr>
<tr>
<td>(b) Slight horizontal movement at arm’s length.</td>
<td>Reduce speed</td>
</tr>
<tr>
<td>(c) Raised and lowered vertically.</td>
<td>Proceed</td>
</tr>
<tr>
<td>(d) Swung vertically in a circle at right angle to the track.</td>
<td>Back</td>
</tr>
<tr>
<td>(e) Swung horizontally.</td>
<td>Apply air brakes</td>
</tr>
<tr>
<td>(f) Held at arm’s length above the head.</td>
<td>Release air brakes</td>
</tr>
<tr>
<td>(g) Any object waved violently by anyone on or near the track.</td>
<td>Stop</td>
</tr>
</tbody>
</table>

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

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.
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 shuff-shuff 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 without any 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 blowers and radiator assembly.

Diesel (and electric) wheel arrangements are expressed in terms of axles, not wheels. "A-A" indicates a single powered axle, "B-B" means 2 together. "C-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 axles 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.
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.

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.

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? _________________________
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” rerailer
- 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.
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 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.

ALWAYS EXPECT A TRAIN
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 guages.

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 guage .075 inches equals one foot of the prototype. In G guage, 3/8 inch equals one foot of the prototype. The guages we will work with are:

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