



Railroading Merit Badge





Railroading Merit Badge Requirements



1. Do THREE of the following:
 - a. Name three types of modern freight trains. Explain why unit trains are more efficient than mixed freight trains.
 - b. Name one Class I or regional railroad. Explain what major cities it serves, the locations of major terminals, service facilities, and crew change points, and the major commodities it carries.
 - c. Using models or pictures, identify 10 types of railroad freight or passenger cars. Explain the purpose of each type of car.
 - d. Explain how a modern diesel or electric locomotive develops power. Explain the terms dynamic braking and radial steering trucks.



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2. Do the following:
 - a. Explain the purpose and formation of Amtrak. Explain, by the use of a timetable, a plan for making a trip by rail between two cities at least 500 miles apart. List the times of departure and arrival at your destination, the train number, and the type of service you want.
 - b. List and explain the various forms of public/mass transit using rail.
3. Do ONE of the following:
 - a. Name four departments of a railroad company. Describe what each department does.
 - b. Tell about the opportunities in railroading that interest you most and why.
 - c. Name four rail support industries, Describe the function of each one.
 - d. With your parent's and counselor's approval, interview someone employed in the rail industry. Learn what that person does and how this person became interested in railroading. Find out what type of schooling and training are required for this position.



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4. Explain the purpose of Operation Lifesaver and its mission.
5. Do THREE of the following:
 - a. List five safety precautions that help make trains safer for workers and passengers.
 - b. Explain to your merit badge counselor why safety around rights-of-way is important.
 - c. List 10 safety tips to remember when you are near a railroad track (either on the ground or on a station platform) or aboard a train.
 - d. Tell your counselor about the guidelines for conduct that should be followed when you are near or on railroad property. Explain the dangers of trespassing on railroad property.
 - e. Tell what an automobile driver can do to safely operate a car at grade crossings, and list three things an automobile driver should never do at a grade crossing.
 - f. Tell how to report a malfunction of grade crossing warning devices.
 - g. List safety precautions a pedestrian should follow at a public crossing.



Railroading Merit Badge Requirements



6. Explain the appearance and meaning of the following warning signs and devices: advance warning sign, pavement markings, crossbucks, flashing red lights, crossing gates.
7. Do EACH of the following:
 - a. Explain how railroad signals operate and show two basic signal types using color and configuration.
 - b. Explain the meaning of three horn signals.
 - c. Describe a way to signal a train for an emergency stop.
 - d. Explain the use and function of the EOTD (end-of-train device) or FRED (Flashing rear end device) used on the last car of most freight trains.



Railroading Merit Badge Requirements



8. Select ONE of the following special-interest areas and complete the requirements:

a. Model Railroading

With your parent's and counselor's approval, do TWO of the following:

1. Draw a layout of your own model railroad; or one that could be built in your home. Design a point-to-point track or loop with different routings. Include one of the following: turnaround or terminal or yard or siding.
2. Build one model railroad car kit or one locomotive kit.
3. Name the scale of four popular model railroad gauges. Identify the scale of four model cars or locomotives.
4. Locate the website of four model railroad - related manufacturers or magazine publishers. Print information on their products and services and discuss the information with your counselor.
5. Build one railroad structure (from scratch or using a kit), paint and weather the structure, mount it on your layout or diorama, and make the surrounding area on a diorama scenic.
6. Alone or with others, build a model railroad or modular layout, including ballast and scenery. Make electrical connections and operate a train. Describe what you enjoyed most.
7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



Railroading Merit Badge Requirements

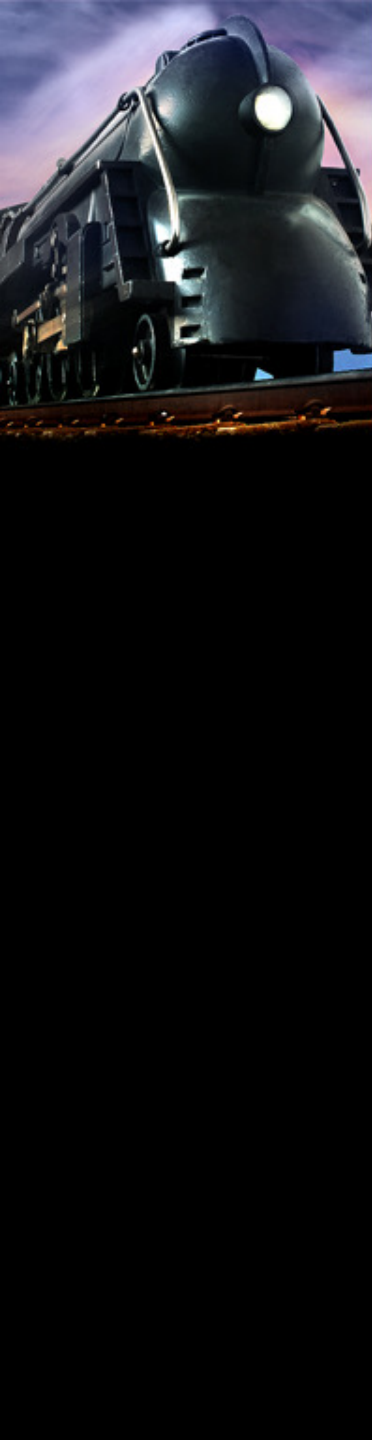


8. Select ONE of the following special-interest areas and complete the requirements:

b. Railfanning

With your parent's and counselor's approval, do TWO of the following:

1. Visit a railroad museum, historical display, or a prototype railroad-sponsored public event. With permission, photograph, videotape, or sketch items of interest. Explain what you saw and describe your photos, sketches, or videotape.
2. Purchase tickets and ride a scenic or historic railroad. Under supervision, photograph the equipment and discuss with your counselor the historic significance of the operation.
3. Locate the website of four rail historical groups, then find information on the history of the rail preservation operations and purpose of each group. Talk with a member of one of the groups and find out how you might help.
4. Plan a trip by rail between two points. Obtain a schedule and explain when the train should arrive at two intermediate points. Purchase the tickets and make the trip. Explain to your counselor what you saw.



Requirement 1



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- b. Name one Class I or regional railroad. Explain what major cities it serves, the locations of major terminals, service facilities, and crew change points, and the major commodities it carries.
- c. Using models or pictures, identify 10 types of railroad freight or passenger cars. Explain the purpose of each type of car.
- d. Explain how a modern diesel or electric locomotive develops power. Explain the terms dynamic braking and radial steering trucks.



1a. Three Types of Modern Freight Trains

Mixed Freight

- Mixed trains carry a variety of freight in different types of railcars.
- The individual cars are ultimately headed for different destinations so the mixed train usually goes through a classification yard.





1a. Three Types of Modern Freight Trains

Unit Trains

- Unit trains haul a single freight or commodity such as coal, automobiles, oil, or grain.
- They use the same type of car to run between two points with no loading or unloading stops in between.
- These trains usually deliver their freight to one destination, saving a lot of time because they don't have to be sorted in a classification yard and redirected.



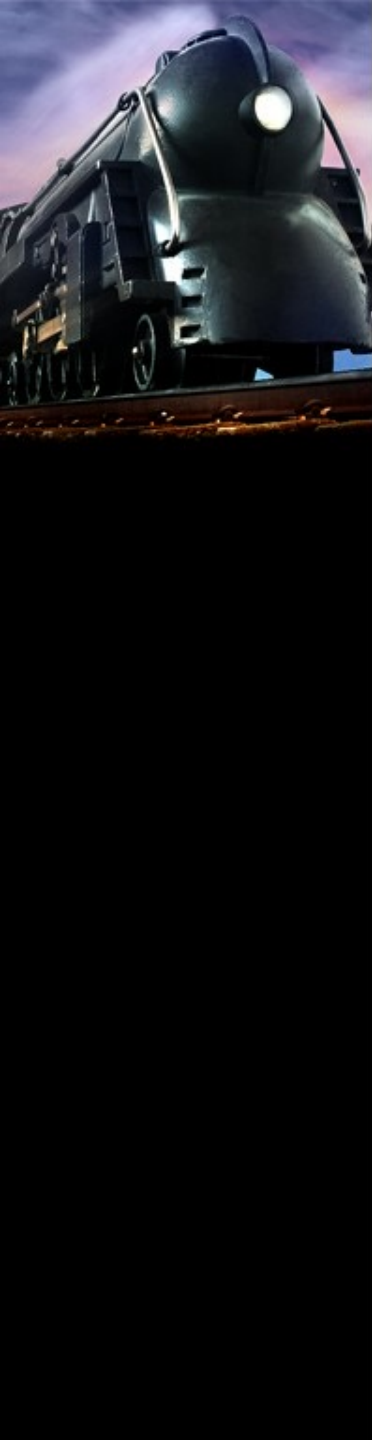


1a. Three Types of Modern Freight Trains

Intermodal Trains

- These trains haul standardized, space-saving containers and trailers that are also carried on trucks and ships.
- This method of shipping is called containerization.
- It saves shippers considerable time and handling expense while protecting the cargo from the weather, damage, and theft.
- Intermodal containers can move as singles loaded on flatcars, or as double-stacks with containers stacked two-high.





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1b. Class 1 Railroads

- The seven Class 1 railroads are BNSF Railway Co., CSX Transportation, Grand Trunk Corporation (Canadian National's operations), Kansas City Southern Railway, Norfolk Southern, Soo Line Corporation (Canadian Pacific's operations), and Union Pacific Railroad.
- Click on the hyperlinks to find out what major cities they serve, the locations of their major terminals, service facilities, and crew change points, and the major commodities they carry.

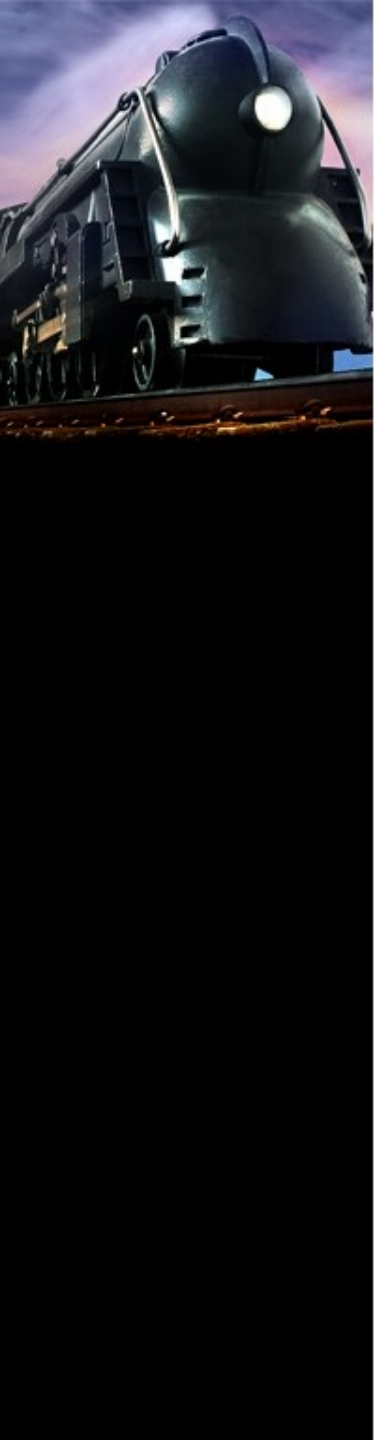




1b. Regional Railroads

- In the United States, a **regional railroad** is a railroad company that is not Class I, but still has a substantial amount of traffic or trackage (and is thus not a short line).
- Click on the hyperlink for information on [Regional Railroads](#) to learn what major cities they serve, the locations of major terminals, service facilities, and crew change points, and the major commodities it carries.





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1c. Railcars

- **Flatcars** are used for loads that are too large or cumbersome to load in enclosed cars such as boxcars.



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1c. Railcars

- **Heavy capacity flatcars** were developed to move very heavy loads.
- The extra wheels on each end of the car help to distribute the weight.
- They may have a depressed center to handle excess-height loads.





1c. Railcars

- **Bulkhead Flatcars** are designed with sturdy end-walls (bulkheads) to prevent loads from shifting past the ends of the car.





1c. Railcars

- **Center-Beam Flatcars** were created to help keep loads from shifting from side to side, and are often used for shipping lumber.





1c. Railcars

- **Trailer-on-Flatcar (TOFC)** are flatcars designed to have a tractor trailer driven up a loading ramp onto the flatcar.
- They have special supports for the front end of the trailer.





1c. Railcars

- An **autorack**, also known as an **auto carrier**, is a specialized piece of railroad rolling stock used to transport automobiles and light trucks.





1c. Railcars

- **Road-Railer Trains** are "Bi-Modal", meaning that the trailers can be used in two modes of service (road and rail).
- These tractor trailers have special features that make it quick and easy to connect them to special train wheelsets and raise their road wheels.
- At their rail destination, the road wheels are lowered, and another truck drives them to their final destination.





1c. Railcars

- **Intermodal Cars** (also called Well Cars, or the trademarked name "Stack Trains") are meant to carry the standard-sized intermodal freight containers.
- These containers can move from ships, to trailers, to trains using cranes at intermodal freight terminals.





1c. Railcars

- **Gondolas** are a flatcar with short or tall walls.
- The walls keep the freight from shifting during transit, but don't protect it from the weather.
- They are used to carry loads that can be loaded by dropping into the car, and can be unloaded by picking it up from above the car.





1c. Railcars

- **Coiled Steel** cars are a variation of the gondola.
- These cars have a cover that can be attached after the freight is loaded which provides protection in transit.
- At the destination, the covers are lifted off, and the freight is removed using cranes.





1c. Railcars

- **Boxcars** were designed to cover freight that needed to be covered or secured while in transit.
- They keep the sun off the freight, dry from the rain, and protect it from rocks and debris while on its trip.





1c. Railcars

- **Livestock Cars** are boxcars made to move livestock, most often cattle.
- They have gaps between slats to allow good air circulation for the animals, while keeping them corralled during their trips.
- Some cars have multiple levels, for carrying smaller animals.





1c. Railcars

- **Refrigerated Boxcars** are designed to get fresh produce to market across longer distances.
- These modified boxcars have insulated floors, roof, and walls, to keep the sun and outside temperatures from affecting the freight.
- Modern Refrigerated Boxcars have a refrigerator, similar to the one in your kitchen, with a generator and a fuel tank on each of these cars.





1c. Railcars

- **Hoppers** look like a gondola with their tall sides,
- These cars are meant to have freight (rocks, coal, etc.) dropped into the top, but are unloaded through the chutes at the bottom of the car.
- These cars have steep, angular sides on the inside of the car, to help the freight move out when the discharge ports are opened.





1c. Railcars

- A **tank car** is a type of railroad car or rolling stock designed to transport liquid and gaseous commodities.





1c. Railcars

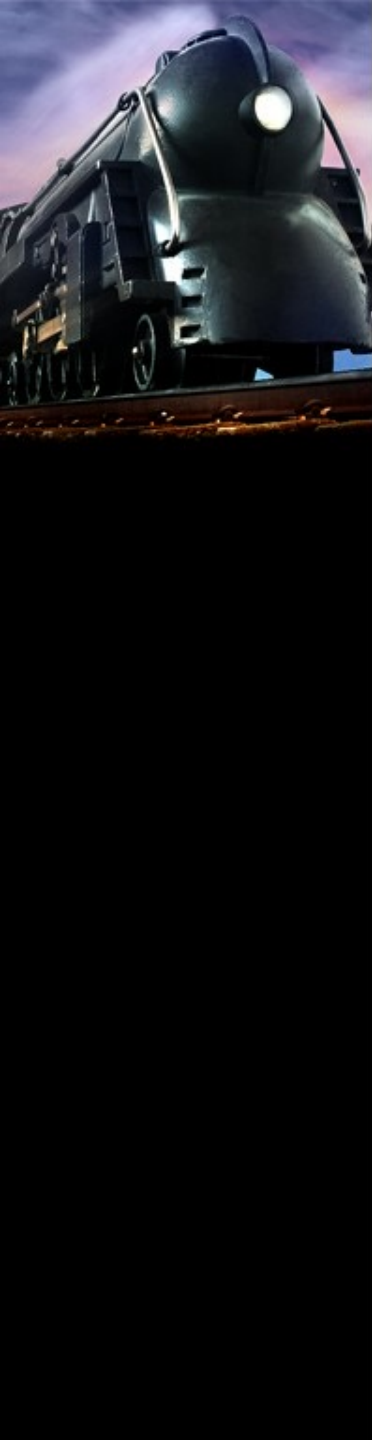
- A caboose was a manned North American railroad car coupled at the end of a freight train.
- Caboosees provided shelter for crew at the end of a train, who were formerly required in switching and shunting, keeping a lookout for load shifting, damage to equipment and cargo, and overheating axles.



1c. Railcars

- A passenger car is an item of railway rolling stock that is designed to carry passengers.
- The term passenger car can also be associated with a sleeping car, a baggage car, a dining car, railway post office and prisoner transport cars.





Requirement 1



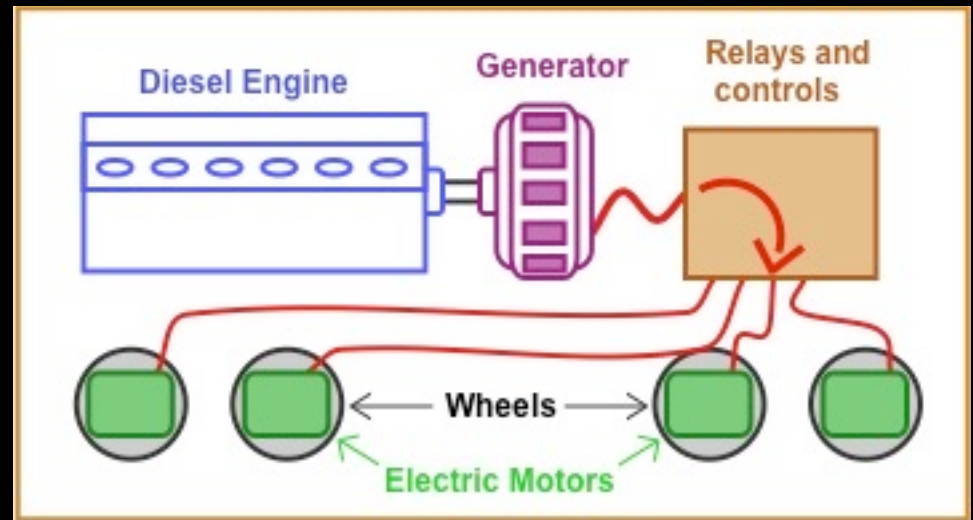
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1d. Train Power

- A diesel-electric locomotive, the most common locomotive in service today, has a main diesel engine, which runs a large generator.
- The generator produces electricity to power the electric traction motors, which are mounted – one per axle – on the power trucks.





1d. Dynamic Braking

- A train typically stops by using an air brake system, which allows the engineer to apply the brakes to all cars at once by forcing the brake shoes against the wheel rims with air pressure.
- On locomotives with electric drive motors, an electromagnetic system allows the motors to act as temporary generators during deceleration.
- The electrical current produced during braking is directed to large resistors, converted to heat, and then released into the atmosphere.
- This is known as **Dynamic Braking**.
- By doing this, the motors are harder to turn, which effectively slows the train down without using the air brakes saving wear and tear on the brake shoes and wheel rims.

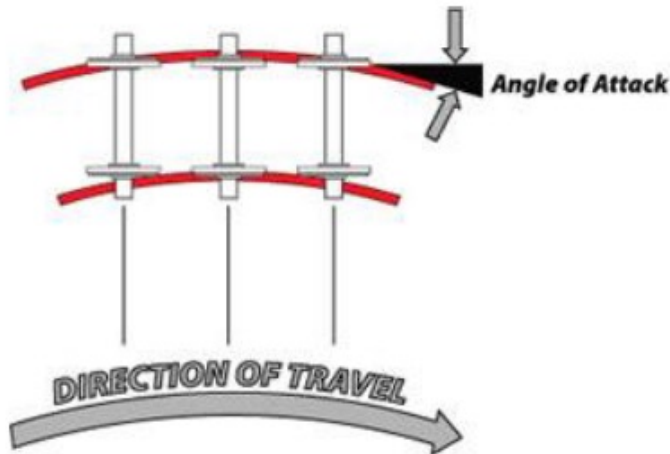
Cooling Grill for Brake Resistors





1d. Radial Steering Trucks

Conventional



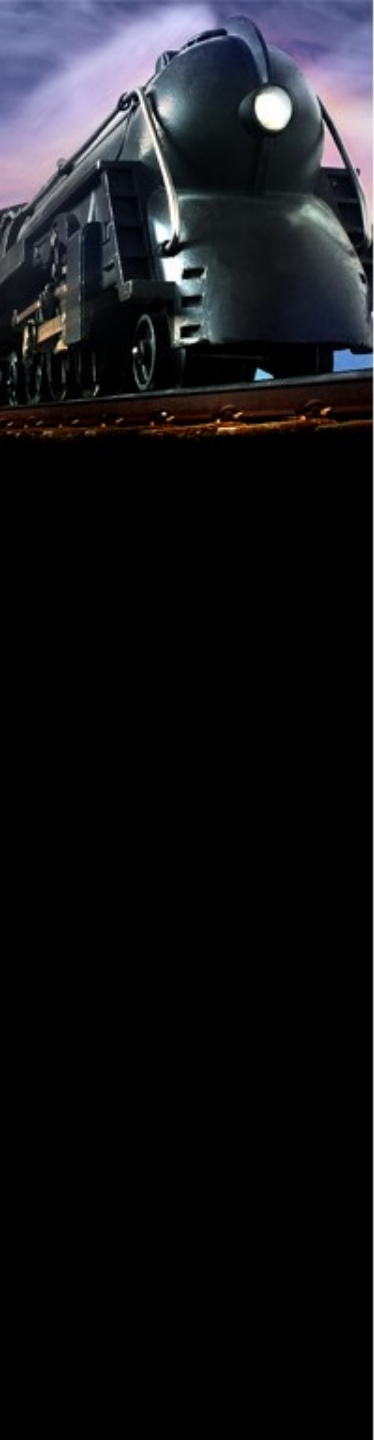
Wheels mounted in a conventional rigid bogie cannot conform to curves. Their flanges bite into the gauge face of the rail, wearing metal from both surfaces.

Patented Radial Bogie



The EMD radial bogie reduces the angle of attack, and literally steers through curves, keeping wheels parallel to the direction of the track.

- A locomotive's "trucks" are the complete assemblies of driving wheels, axles, gearboxes, brakes, coil springs, and other parts – mounted in a frame.
- Radial steering trucks are hinged to flex and steer the wheels smoothly through curves.
- These trucks reduce wheel and track wear and provide better adhesion.



Requirement 2



Do the following:

- a. Explain the purpose and formation of Amtrak. Explain, by the use of a timetable, a plan for making a trip by rail between two cities at least 500 miles apart. List the times of departure and arrival at your destination, the train number, and the type of service you want.
- b. List and explain the various forms of public/mass transit using rail.



Amtrak

America's Passenger Rail Service

- In 1971, the U.S. Congress created the National Railroad Passenger Corporation known as Amtrak.
- It's purpose was to take over and operate the nation's intercity passenger rail service to relieve the nation's private railroads of all passenger service, which had become unprofitable because of competition from automobiles and airplanes.
- In 2018, Amtrak served 31.7 million passengers a year over 21,400 miles of track, almost all of it owned by the Class I freight railroads.
- The exception is the Northeast Corridor where Amtrak owns and maintains most of the high speed electrified rail line between Boston, MA and Washington, D.C.

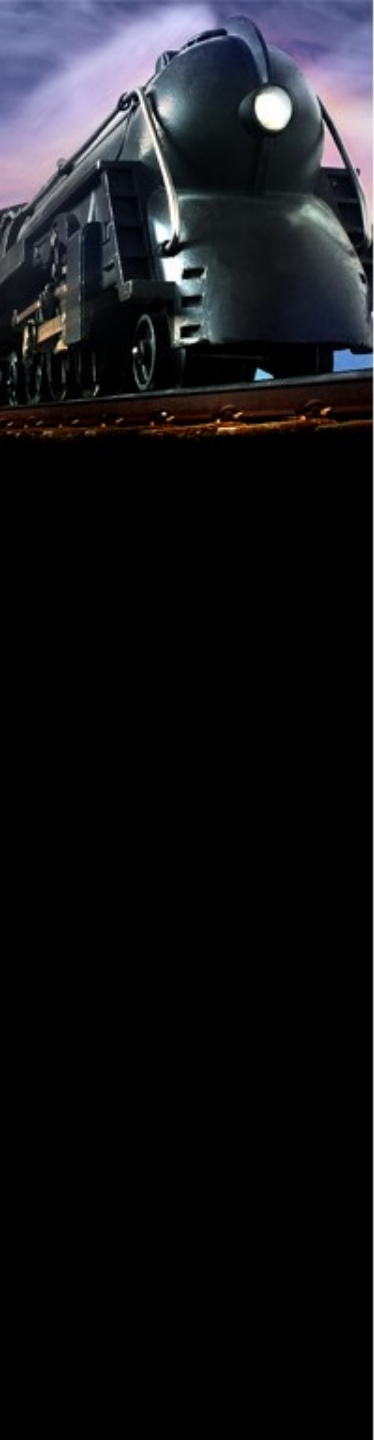




Plan a 500 mile trip by train

- Use the Amtrak website by clicking on the Amtrak icon to plan your trip.
- You do NOT have to buy tickets. Remember what you need to list for this part;
 - Departure City:
 - Destination City:
(The two cities must be more than 500 miles apart.)
 - Departure date and time:
 - Arrival date and time:
 - Train Number(s):
(If you connect with other trains or buses, make a note about them.)
 - Any services you would order, besides basic seating:
- Remember, this can be a dream trip, where money isn't an obstacle. Think about the amount of time that you will be on the train. If the trip takes more than a day, you may want to arrange for sleeping accommodations. (What are your choices? What are the costs?) You may also want to arrange for meals on the train. (Will you pack food that will last without refrigeration, or will you pay for food on the train? What options are offered?)





Requirement 2



Do the following:

- a. Explain the purpose and formation of Amtrak. Explain, by the use of a timetable, a plan for making a trip by rail between two cities at least 500 miles apart. List the times of departure and arrival at your destination, the train number, and the type of service you want.
- b. List and explain the various forms of public/mass transit using rail.



Public/Mass Transit Using Rail

- Light Rail trains usually use overhead electric power, electric motors under each coach, and using a rail gauge slightly different from standard trains.
- They normally operate away from regular train lines, and closer to metropolitan and urban population centers.





Public/Mass Transit Using Rail

- A third rail, also known as a live rail, electric rail or conductor rail, is a method of providing electric power to a railway locomotive or train, through a semi-continuous rigid conductor placed alongside or between the rails of a railway track.
- Third-Rail Trains have power pick-ups below the train body.
- It is used typically in a mass transit or rapid transit system.





Public/Mass Transit Using Rail

- Subway trains are an underground railway system used to transport large numbers of passengers within urban and suburban areas.
- Subways are usually built under city streets.
- Underground operation helps these trains run reliably during bad weather conditions.





Public/Mass Transit Using Rail

- Streetcars or Trolley Cars were once the chief mode of public transit in hundreds of North American cities and towns.
- They use overhead electrical pickups and rails as a fixed path.
- In many areas they have been replaced by Trolley Buses which use the overhead wires and electric motors but the buses ride on rubber tires so that the bus can move through traffic more easily.





Public/Mass Transit Using Rail

- San Francisco Cable Cars are pulled by a cable running below the street, held by a grip that extends from the car through a slit in the street surface, between the rails.
- The *Gripman* uses a device to grab the moving cable under the street to pull the car up and down the hills, and he uses brakes on the car to slow and stop the car.

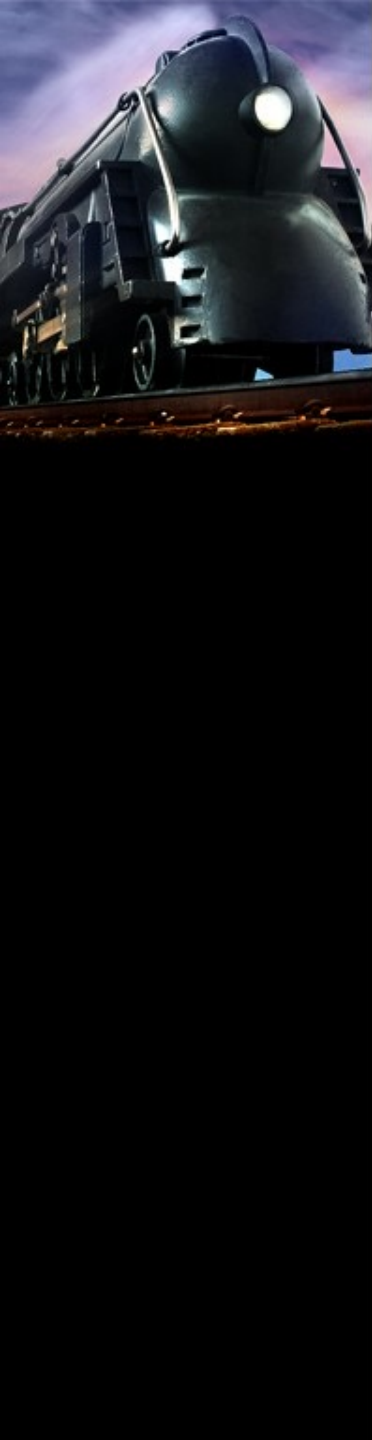




Public/Mass Transit Using Rail

- A monorail is a railway system in which the track consists of a single rail.
- Many monorail systems run on elevated tracks through crowded areas that would otherwise require the construction of expensive underground lines or have the disadvantages of surface lines.





Requirement 3



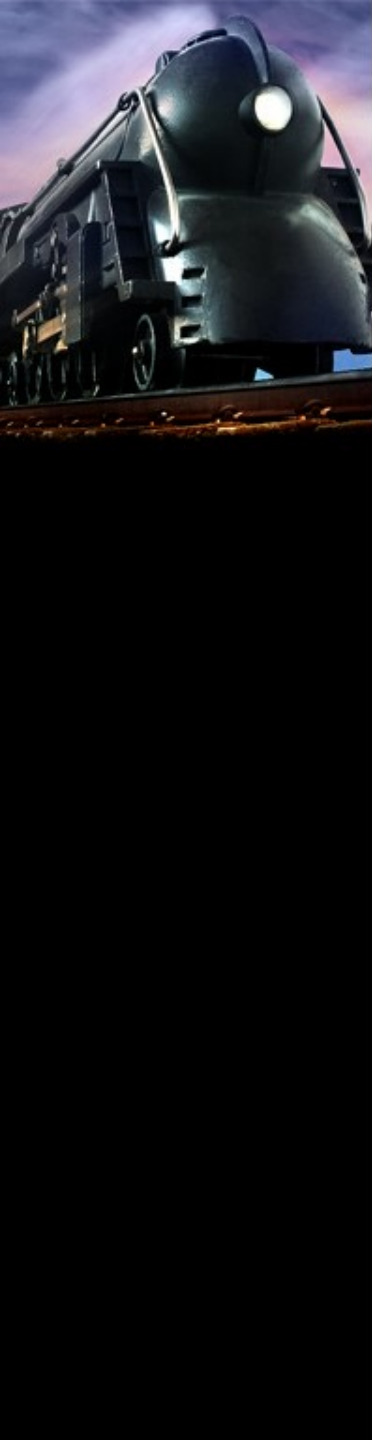
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- b. Tell about the opportunities in railroading that interest you most and why.
- c. Name four rail support industries, Describe the function of each one.
- d. With your parent's and counselor's approval, interview someone employed in the rail industry. Learn what that person does and how this person became interested in railroading. Find out what type of schooling and training are required for this position.



Departments of a Railroad

- **Executive and Management** – Run the various departments. Executives who work within these departments must make sure all functional areas are run effectively.
- **Operations** – manages the trains, other rolling stock, and roadbed.
- **Transportation** – schedules trains.
- **Mechanical** – repairs and inspections.
- **Engineering** – planning layout of tracks and other facilities, and signaling.
- **Sales** – market and sell the railroad's services
- **Legal** – handles all legal matters.
- **Finance** – track revenue and expenses and the purchase of needed supplies and equipment.
- **Human Resources** – handles employment and benefits.
- **Public Relations** – Inform the public, prospective customers, investors, partners, employees, and other stakeholders, and ultimately persuade them to maintain a positive or favorable view about the organization.



Requirement 3



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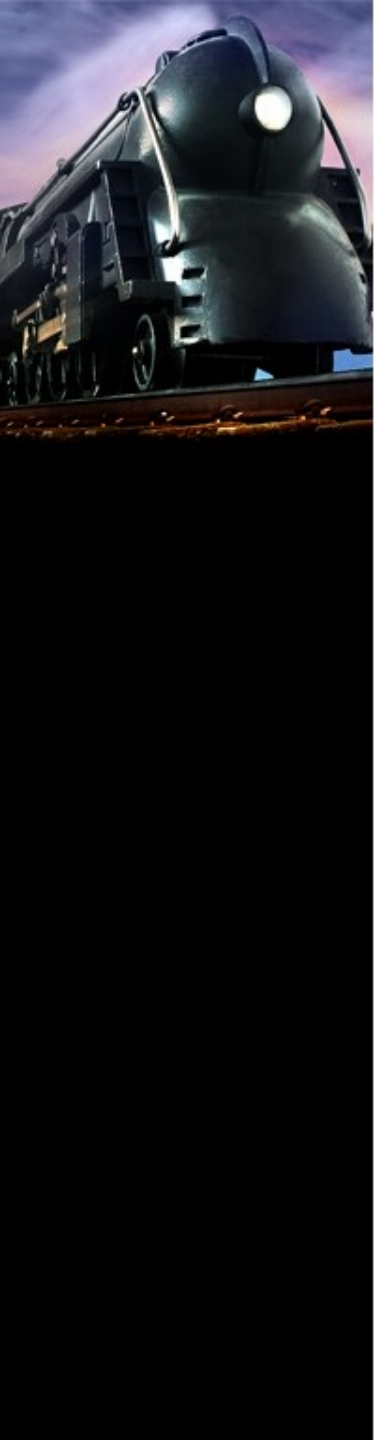
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Opportunities in Railroading

- The railroads have many different jobs, and different departments which include:
 - Operating the trains (the on-train crew)
 - Servicing, repairing and rebuilding trains
 - Building track, structures (buildings and bridges), power and signaling.
- For this requirement, you should think about what you would like to do, and look at some of the jobs that the railroads have available. Pick your favorite job, and tell why you would like to do that job.
- Railroad Job Links:
 - [Union Pacific](#)
 - [Canadian National](#)
 - [CSX](#)
 - [Canadian Pacific](#)
 - [Burlington Northern / Santa Fe](#)
 - [Amtrak](#)





Requirement 3



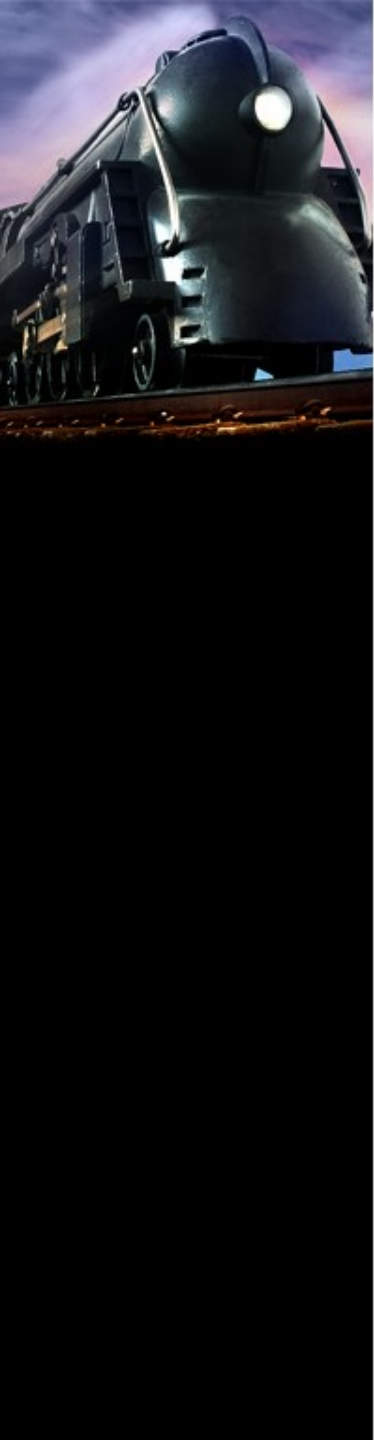
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Rail Support Industries

- The Herzog Companies provide temporary services that can help supplement the workforce of a railroad.
- LORAM makes special equipment for railroads
- Railworks specializes in track building, in North America. This includes restoration of existing tracks, installing new tracks, and even things that connect to the track, like the signaling systems.
- H & H Engineering provides track building, inspection services, and track rehabilitation services in the Western U.S.
- TTX has been supplying a collection of freight cars to its member/owner railroads, so that the railroads do not need to purchase large groups of cars that might not always be used.
- FreightCar America designs special heavy-duty (50-year service life) freight cars.
- Balfour Beatty Rail provide track and signal construction and provide expertise in electrified train systems.
- (GEISMAR) Modern Track Machinery makes specialized equipment that makes it fast, easy, and consistent to install track and overhead lines.



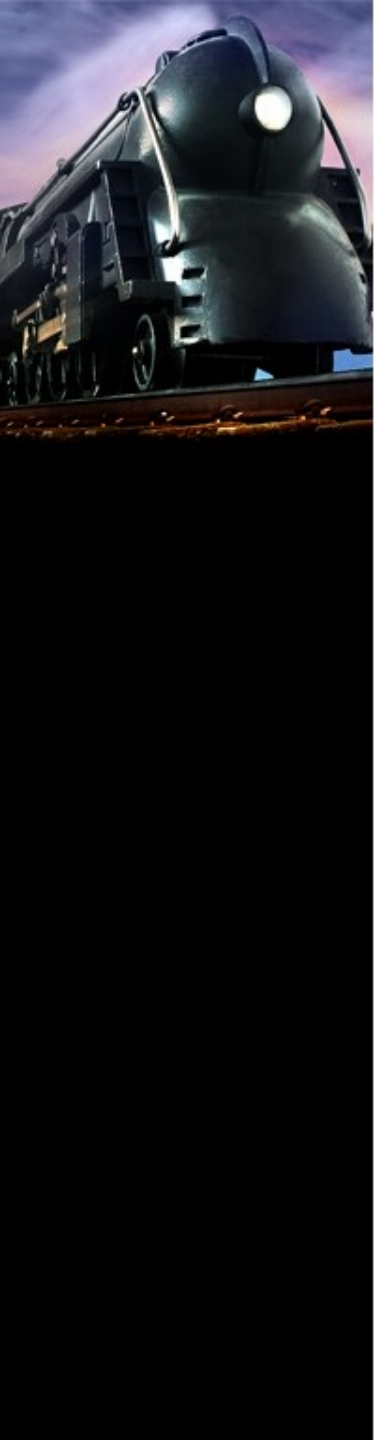
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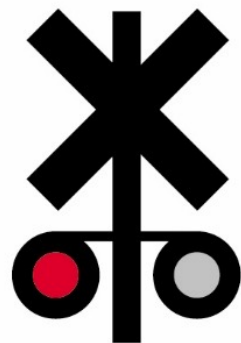


Explain the purpose of Operation Lifesaver and its mission.



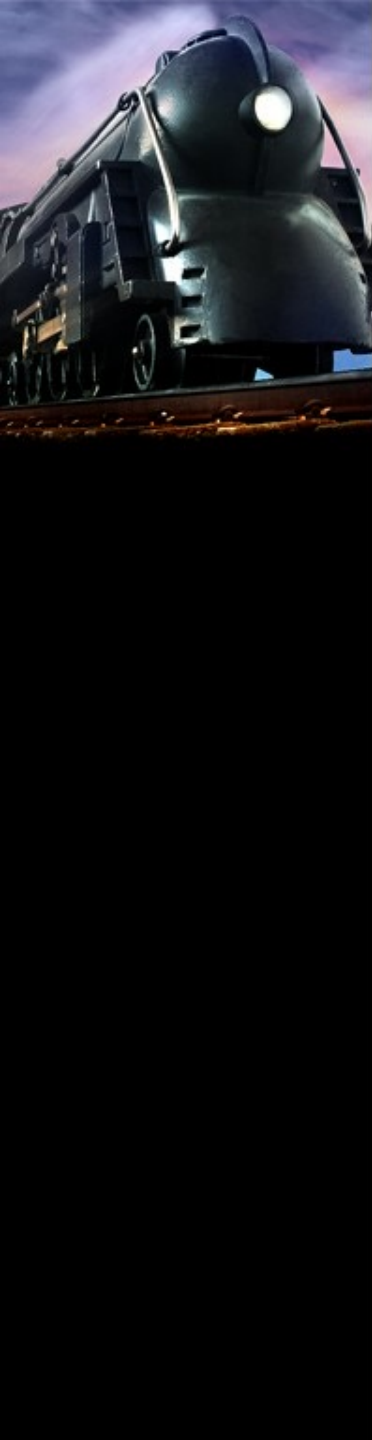
Operation Lifesaver

- Operation Lifesaver is a non-profit organization that provides public education programs in states across the U.S. to prevent collisions, injuries, and fatalities on and around railroad tracks and highway-rail grade crossings.



**OPERATION
LIFESAVER®**

Look, Listen & Live



Requirement 5



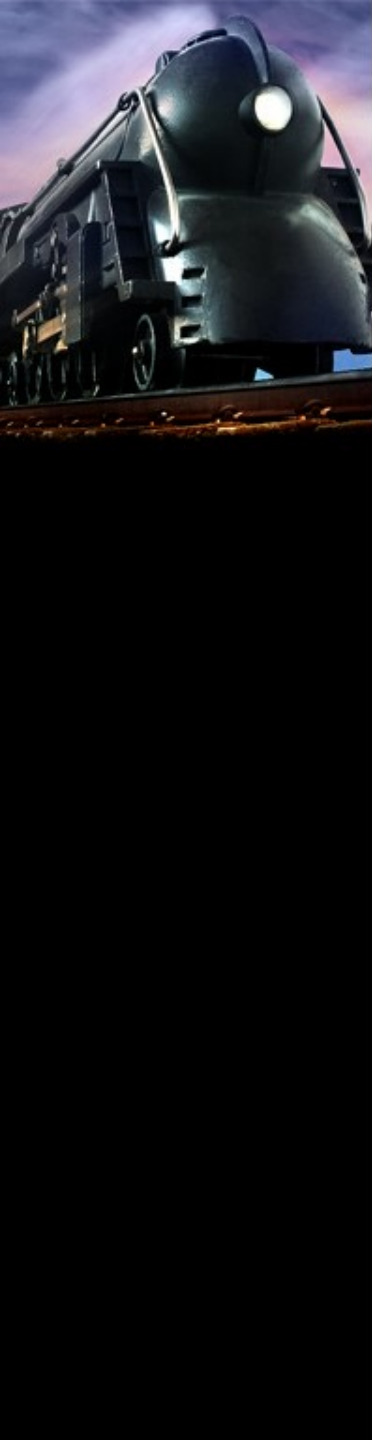
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- a. List five safety precautions that help make trains safer for workers and passengers.
- b. Explain to your merit badge counselor why safety around rights-of-way is important.
- c. List 10 safety tips to remember when you are near a railroad track (either on the ground or on a station platform) or aboard a train.
- d. Tell your counselor about the guidelines for conduct that should be followed when you are near or on railroad property. Explain the dangers of trespassing on railroad property.
- e. Tell what an automobile driver can do to safely operate a car at grade crossings, and list three things an automobile driver should never do at a grade crossing.
- f. Tell how to report a malfunction of grade crossing warning devices.
- g. List safety precautions a pedestrian should follow at a public crossing.



Safety Precautions

- **Stay Alert:** Trains can come from either direction at any time and can be very quiet. Around train tracks or in stations, obey all warning signs and signals and use caution when using headsets or cell phones.
- **Watch the Overhang:** Trains are wider than the tracks; never sit on the edge of a station platform.
- **Stand Away from the Platform Edge:** Pay attention to painted or raised markings at the platform edge, and stay at least three feet from the train while it is coming in or out of the station.
- **When On Board, Hold On:** Hold on tight to poles or seats, and listen carefully to directions from the train operator or conductor.
- **Watch Your Step:** Be careful getting on and off the train - there may be a gap between the train and platform or steps.
- **Don't Take Shortcuts with Your Life:** Follow directional signs and markings that let you know where it is safe to cross the tracks. Crossing the tracks anywhere else is dangerous and illegal.



Requirement 5



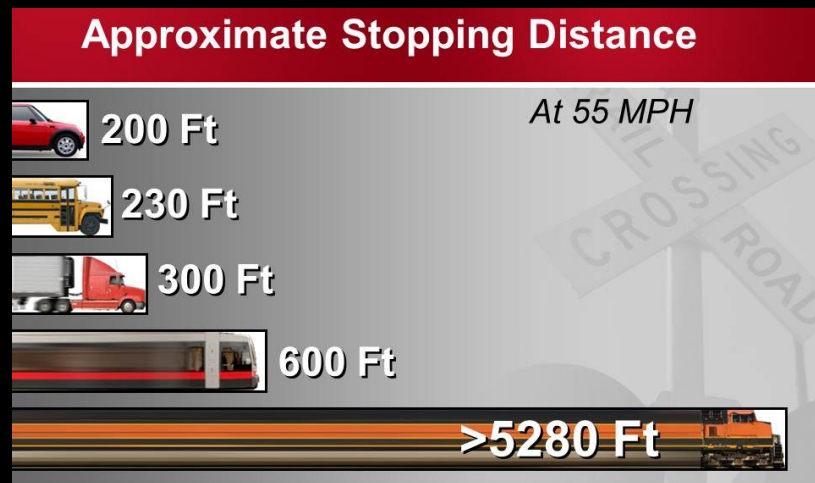
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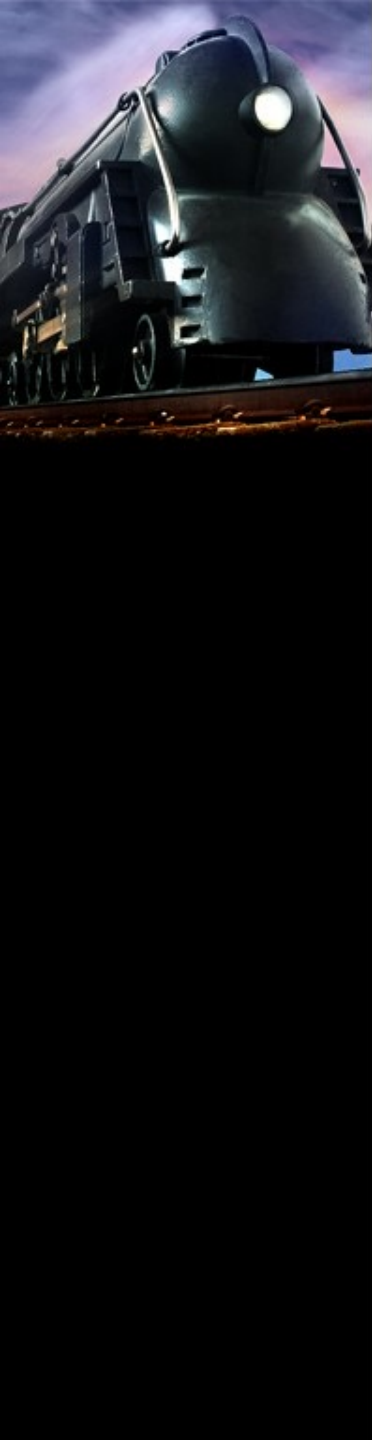
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Train Track Safety Basics

- All train tracks are private property. Never walk on tracks; it's illegal trespass and highly dangerous. It takes the average freight train traveling at 55 mph more than a mile to stop making it impossible to avoid a collision.
- Freight trains don't travel at fixed times. Always expect a train at each highway-rail intersection at any time.
- A train can extend three feet or more beyond the steel rail, putting the safety zone for pedestrians well beyond the three foot mark.
- Today's trains are quieter than ever, producing no telltale "clackety-clack." Any approaching train is always closer and moving faster, than you think.





Requirement 5



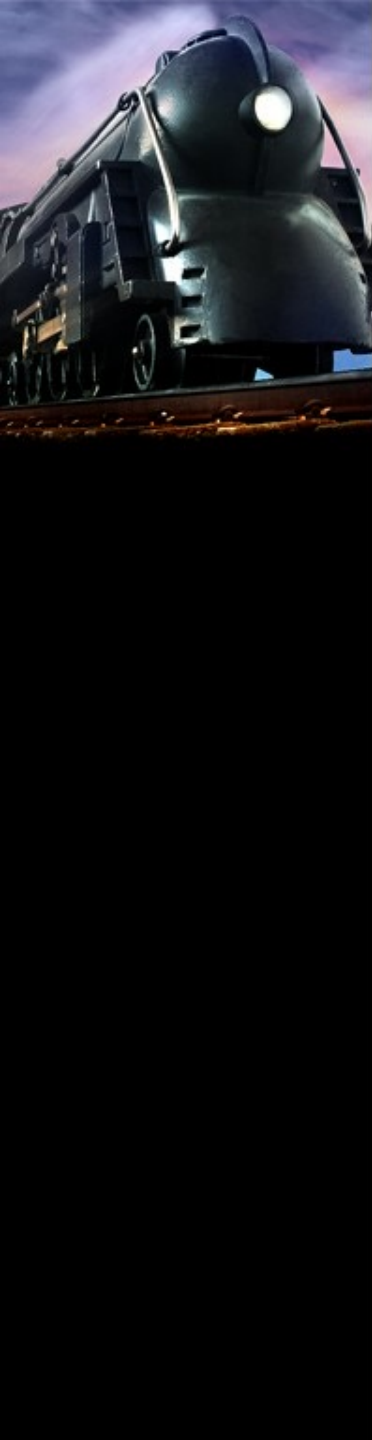
Do THREE of the following:

- a. List five safety precautions that help make trains safer for workers and passengers.
- b. Explain to your merit badge counselor why safety around rights-of-way is important.
- c. List 10 safety tips to remember when you are near a railroad track (either on the ground or on a station platform) or aboard a train.
- d. Tell your counselor about the guidelines for conduct that should be followed when you are near or on railroad property. Explain the dangers of trespassing on railroad property.
- e. Tell what an automobile driver can do to safely operate a car at grade crossings, and list three things an automobile driver should never do at a grade crossing.
- f. Tell how to report a malfunction of grade crossing warning devices.
- g. List safety precautions a pedestrian should follow at a public crossing.



Safety Tips

- Don't play near trains or tracks; pushing and shoving can cause accidents.
- Remember to obey all warning signs and signals.
- Never cross train tracks to get to a platform. Use marked pathways and stairways to get from platform to platform.
- Don't ever try to "beat" a train. An approaching train is closer and moving faster than you think. Don't assume the operator sees you and do not step in front of a train for any reason.
- Always stay behind the yellow lines at train stations. Enter or exit a station platform at designated areas.
- Use care when climbing the steps to your rail car. Hold onto the railing and pay attention to where you walk.
- If you need to move between cars, be aware that gaps may present a trip hazard.
- When boarding train, familiarize yourself with the safety information and emergency procedures on the safety card found in most seat backs.
- Once the train begins to move, keep one hand on a railing or seat back as you walk through the rail cars. It is very easy to lose your balance on a moving train.
- Never attempt to board or exit a moving train.



Requirement 5



Do THREE of the following:

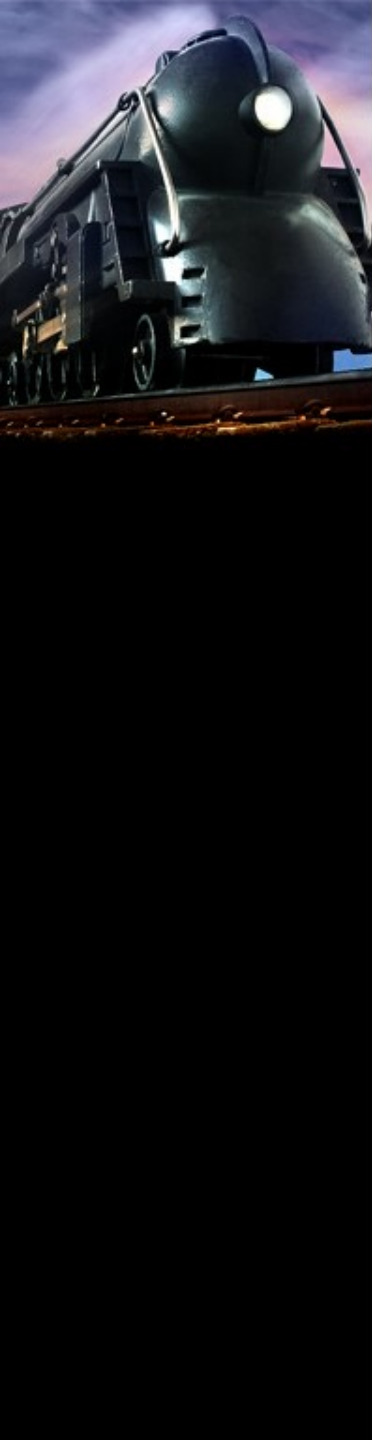
- a. List five safety precautions that help make trains safer for workers and passengers.
- b. Explain to your merit badge counselor why safety around rights-of-way is important.
- c. List 10 safety tips to remember when you are near a railroad track (either on the ground or on a station platform) or aboard a train.
- d. Tell your counselor about the guidelines for conduct that should be followed when you are near or on railroad property. Explain the dangers of trespassing on railroad property.
- e. Tell what an automobile driver can do to safely operate a car at grade crossings, and list three things an automobile driver should never do at a grade crossing.
- f. Tell how to report a malfunction of grade crossing warning devices.
- g. List safety precautions a pedestrian should follow at a public crossing.



Conduct Near or On Railroad Property

- Avoid walking along tracks, especially while wearing earphones.
- Avoid fishing or diving from a railroad bridge or trestle.
- Take an alternate route instead of walking through tunnels, which allow very little clearance.
- Resist the temptation to place items on tracks – even coins to be flattened.
- Leave railroad switches alone.
- Stay away from rolling stock such as sidelined cars, track maintenance equipment, piles of ties, ballast, or stacked rail.





Requirement 5



Do THREE of the following:

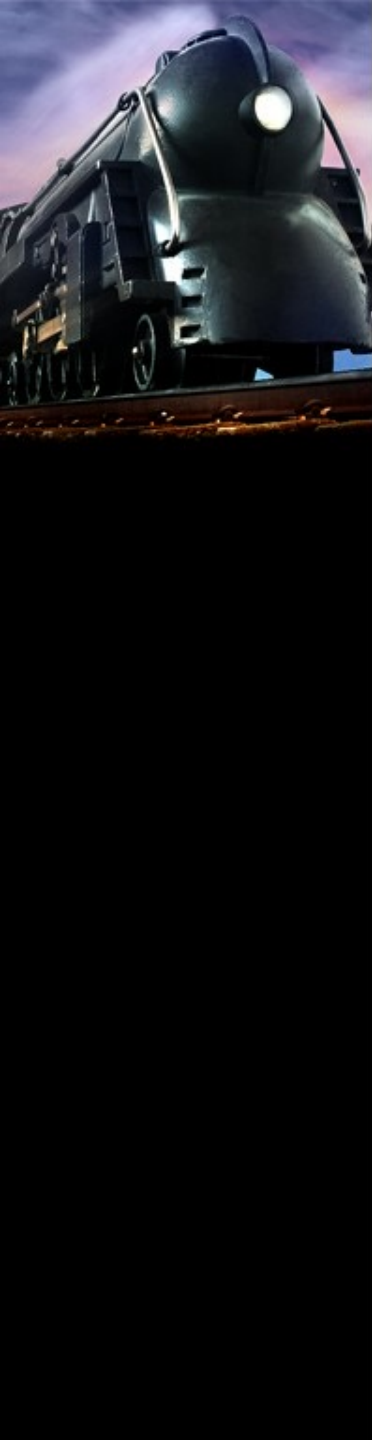
- a. List five safety precautions that help make trains safer for workers and passengers.
- b. Explain to your merit badge counselor why safety around rights-of-way is important.
- c. List 10 safety tips to remember when you are near a railroad track (either on the ground or on a station platform) or aboard a train.
- d. Tell your counselor about the guidelines for conduct that should be followed when you are near or on railroad property. Explain the dangers of trespassing on railroad property.
- e. Tell what an automobile driver can do to safely operate a car at grade crossings, and list three things an automobile driver should never do at a grade crossing.
- f. Tell how to report a malfunction of grade crossing warning devices.
- g. List safety precautions a pedestrian should follow at a public crossing.



Automobiles and Grade Crossings

- Trains have the right of way 100% of the time over emergency vehicles, cars, the police and pedestrians.
 - The average locomotive weighs about 400,000 pounds or 200 tons; it can weigh up to 6,000 tons. This makes the weight ratio of a car to a train proportional to that of a soda can to a car. We all know what happens to a soda can hit by a car.
- Never race a **train** to the crossing. If you tie, you lose.
- Never drive around lowered gates.
- Never stop a vehicle on the tracks.
- Never assume that a passing train is the only train on a multiple-track crossing.
- Never cross the tracks anywhere but at the public grade crossing.





Requirement 5



Do THREE of the following:

- a. List five safety precautions that help make trains safer for workers and passengers.
- b. Explain to your merit badge counselor why safety around rights-of-way is important.
- c. List 10 safety tips to remember when you are near a railroad track (either on the ground or on a station platform) or aboard a train.
- d. Tell your counselor about the guidelines for conduct that should be followed when you are near or on railroad property. Explain the dangers of trespassing on railroad property.
- e. Tell what an automobile driver can do to safely operate a car at grade crossings, and list three things an automobile driver should never do at a grade crossing.
- f. Tell how to report a malfunction of grade crossing warning devices.**
- g. List safety precautions a pedestrian should follow at a public crossing.

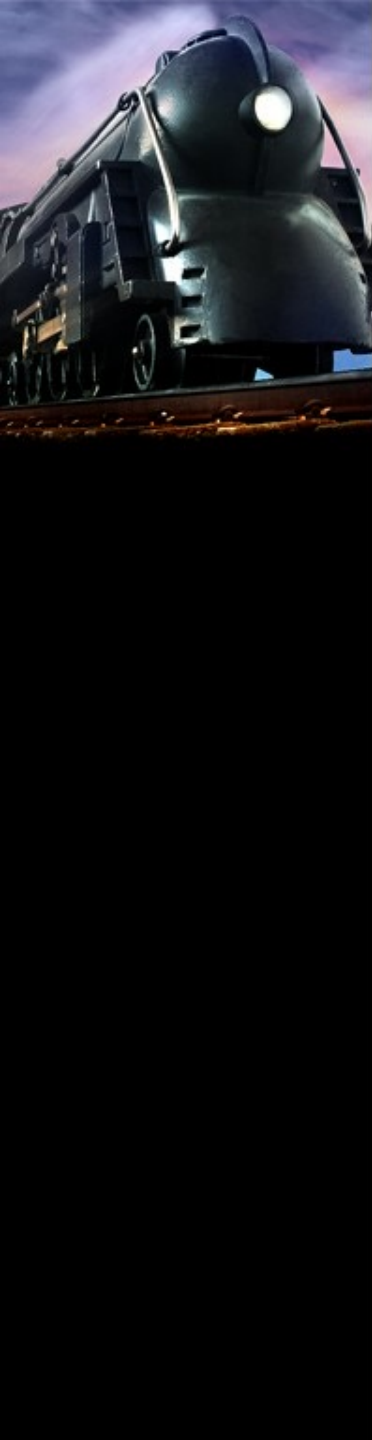


Defective Grade Crossing Devices

- If you think that highway-rail grade crossing signals are not working, immediately call 9-1-1 and report the problem and location.
- Then contact the railroad at the toll-free number posted on the signal building or cabinet at the crossing.



Inoperable Gates and Lights



Requirement 5



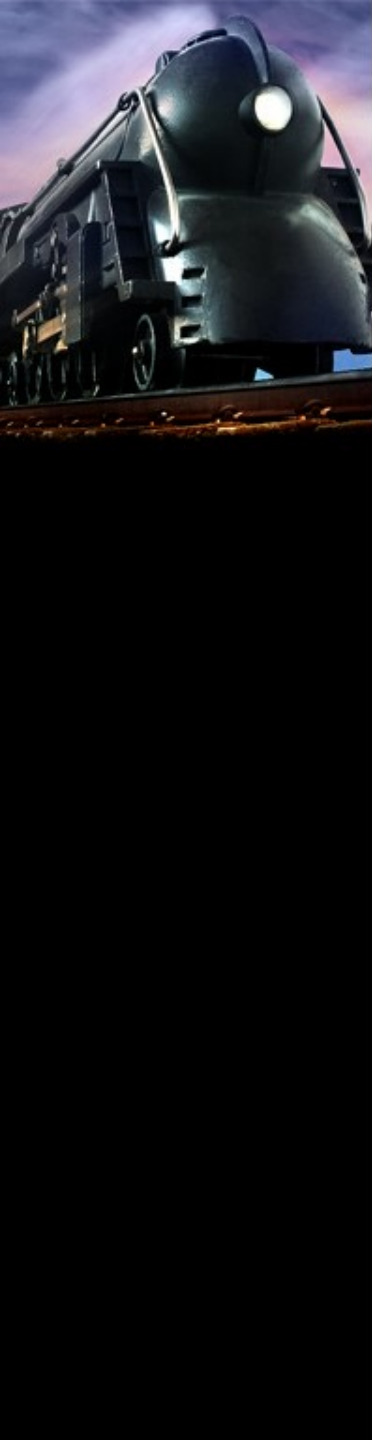
Do THREE of the following:

- a. List five safety precautions that help make trains safer for workers and passengers.
- b. Explain to your merit badge counselor why safety around rights-of-way is important.
- c. List 10 safety tips to remember when you are near a railroad track (either on the ground or on a station platform) or aboard a train.
- d. Tell your counselor about the guidelines for conduct that should be followed when you are near or on railroad property. Explain the dangers of trespassing on railroad property.
- e. Tell what an automobile driver can do to safely operate a car at grade crossings, and list three things an automobile driver should never do at a grade crossing.
- f. Tell how to report a malfunction of grade crossing warning devices.
- g. List safety precautions a pedestrian should follow at a public crossing.



Safety Precautions for Pedestrians

- The only safe place to cross is at a designated public crossing
- Railroad tracks, trestles, yards and equipment are private property and trespassers are subject to arrest and fine. You could be injured or killed in a busy rail yard.
- Trains overhang the tracks by at least three feet in both directions; loose straps hanging from rail cars may extend even further. If you are in the right-of-way next to the tracks, you can be hit by the train.
- Do not cross the tracks immediately after a train passes. A second train might be blocked by the first. Wait until you can see clearly around the first train in both directions.
- Flashing red lights indicate a train is approaching. Never walk around or behind lowered gates at a crossing, and DO NOT cross the tracks until the lights have stopped flashing and it's safe to do so.
- Do not hunt, fish or bungee jump from railroad trestles. There is only enough clearance on the tracks for a train to pass.
- Do not attempt to hop aboard railroad equipment at any time. A slip of the foot can cost you a limb or your life.
- Be aware trains do not follow set schedules. Any Time is Train Time!



Requirement 6



Explain the appearance and meaning of the following warning signs and devices: advance warning sign, pavement markings, crossbucks, flashing red lights, crossing gates.



Railroad Warning Signs

- When approaching a public highway-rail crossing, drivers will see the round, yellow advance warning sign.





Railroad Warning Signs



- Pavement markings are the same as the advance warning sign, but the letters are painted on the road surface and generally start at the advance warning sign and end with a stop bar near the crossing.



Railroad Warning Signs

- The common crossbuck is the basic warning sign required at all public crossings.
- It has the same meaning as a yield sign.
- A smaller sign below the crossbuck indicates multiple sets of tracks.





Railroad Warning Signs

- Busier railroad crossings require active warning devices such as a crossbuck with alternating flashing red lights to warn of the immediate approach of a train.
- If the red lights are flashing at a railroad crossing all vehicles are required to stop even if a train is not in sight.

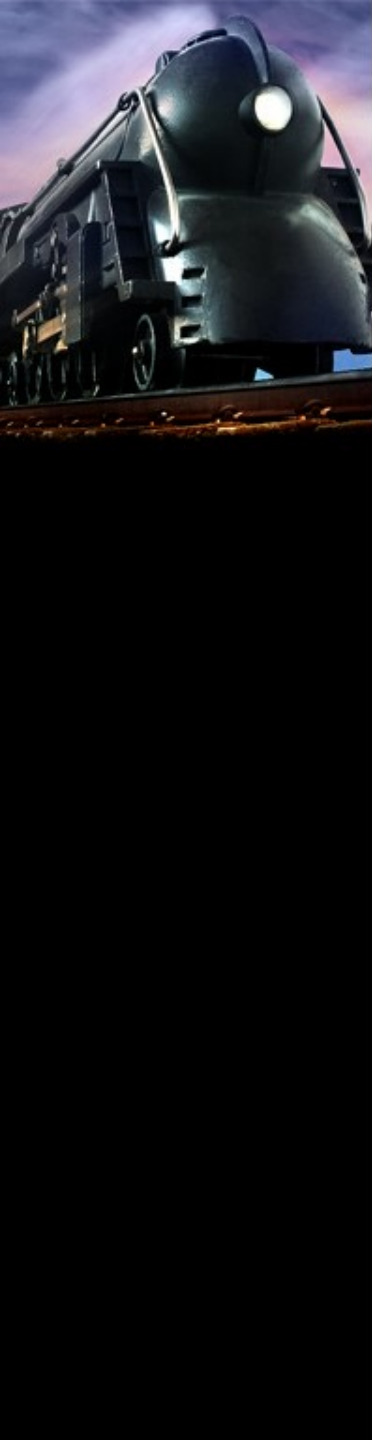




Railroad Warning Signs

- At many crossings, there will be a crossing gate added to the signal.
- The gates will be fully lowered 15 to 20 seconds before the train arrives.
- The gates will rise and the signals will shut off once the end of the train clears the island circuit.
- It is illegal to drive past a lowered crossing gate.





Requirement 7

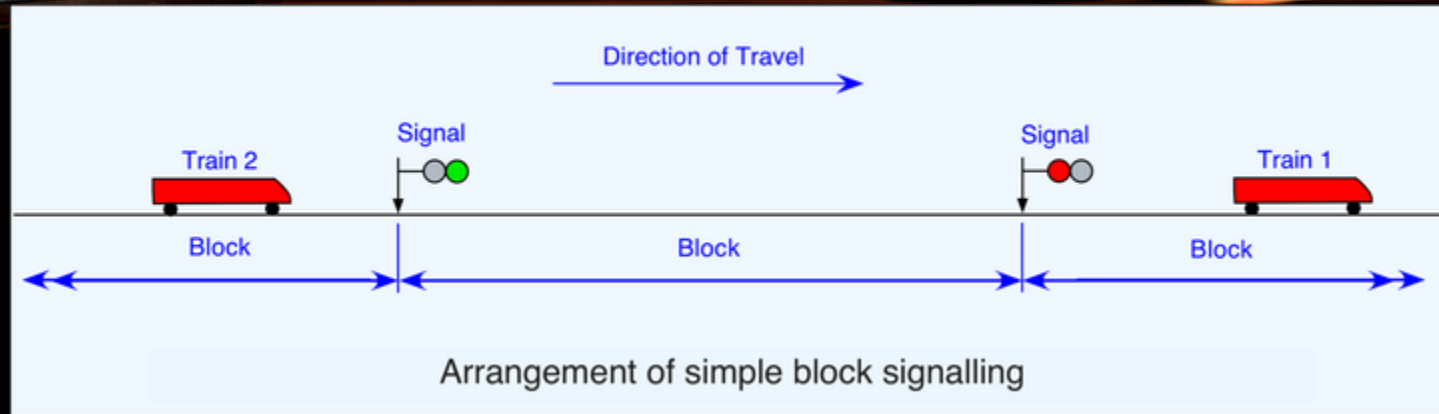


Do EACH of the following:

- a. Explain how railroad signals operate and show two basic signal types using color and configuration.
- b. Explain the meaning of three horn signals.
- c. Describe a way to signal a train for an emergency stop.
- d. Explain the use and function of the EOTD (end-of-train device) or FRED (Flashing rear end device) used on the last car of most freight trains.



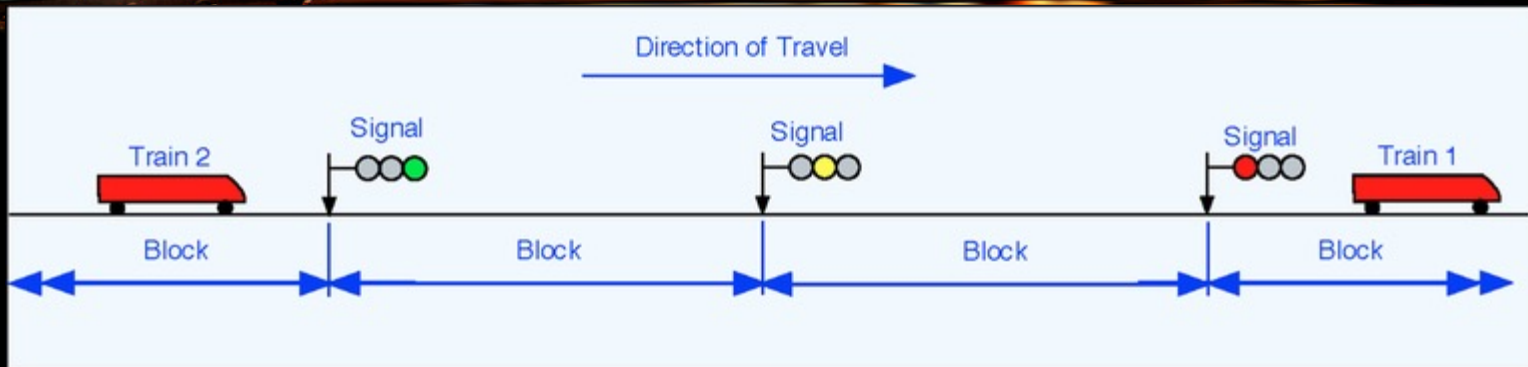
Railroad Visual Signals



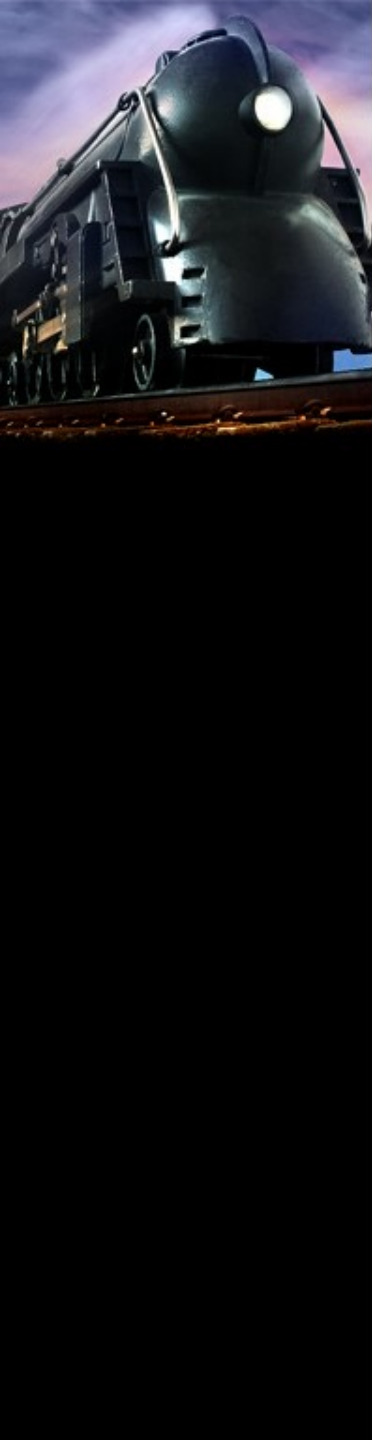
- Railroads divide tracks into sections called blocks.
- In the block layout, each signal is spaced a safe braking distance apart based on the maximum permissible speed for that section of railroad.
- The signals can display three colors, called aspects, and are defined as follows:
 - Green means “proceed at up to maximum permissible speed.
 - Yellow means “proceed at reduced speed; be prepared to stop at next signal.”
 - Red means “stop.”



Railroad Visual Signals



- The diagram shows a line with 3-aspect signals.
- The block occupied by Train 1 is protected by the red signal at the entrance to the block.
- The block behind is clear of trains but a yellow signal provides advanced warning of the red aspect ahead.
 - This block provides the safe braking distance for Train 2.
- The next block in rear is also clear of trains and shows a green signal.
 - The driver of Train 2 sees the green signal and knows he has at least two clear blocks ahead of him and can maintain the maximum allowed speed over this line until he sees the yellow.
- The signaling sequence begins over again for the following train.



Requirement 7



Do EACH of the following:

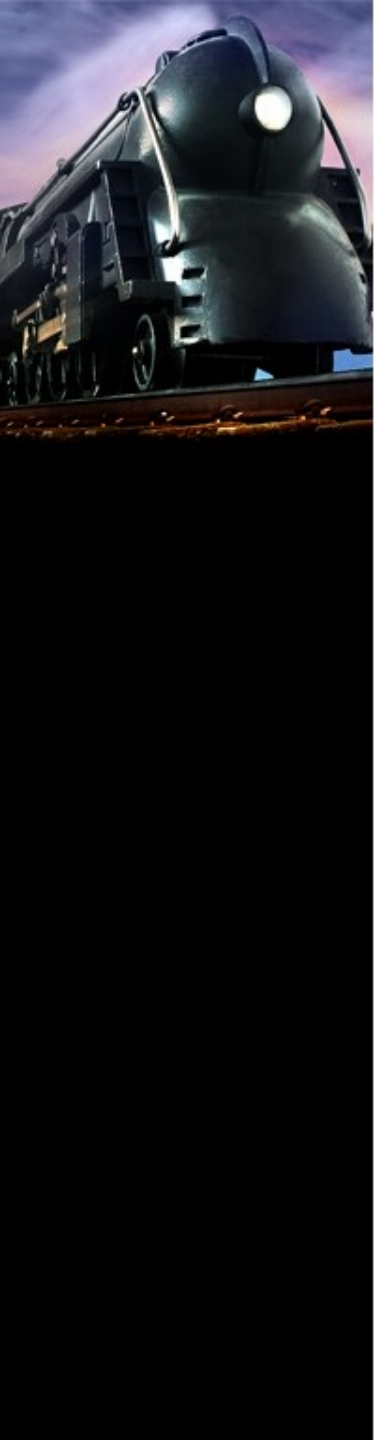
- a. Explain how railroad signals operate and show two basic signal types using color and configuration.
- b. Explain the meaning of three horn signals.**
- c. Describe a way to signal a train for an emergency stop.
- d. Explain the use and function of the EOTD (end-of-train device) or FRED (Flashing rear end device) used on the last car of most freight trains.



Railroad Horn Signals

- The chart includes the required horn signals listed in the operating rules of most North American railroads, along with their meanings.
- Signals are illustrated by an "O" for short sounds, and "-" for longer sounds.

Engine Horn	Meaning
O	Apply brakes. Stop.
OO	Engineer's answer to any signal.
OOO	When standing, back up; when running, stop at next station.
OOOO	Engineer's request for signals.
OOOOOOOOO, etc.	Person or livestock on tracks (series of short blasts).
-----, etc.	Approaching stations, junctions, or railroad crossings at grade (series of long blasts) without stopping.
--	Release brakes. Proceed.
-- O --	Train is approaching public crossing at grade.



Requirement 7



Do EACH of the following:

- a. Explain how railroad signals operate and show two basic signal types using color and configuration.
- b. Explain the meaning of three horn signals.
- c. Describe a way to signal a train for an emergency stop.
- d. Explain the use and function of the EOTD (end-of-train device) or FRED (Flashing rear end device) used on the last car of most freight trains.



Emergency Stop

- If there's a threat to the train, such as an obstruction or person on the tracks ahead of it, wave a red flag vigorously at it to signal to the operator that they need to apply the emergency brakes.
- If you don't have a red flag, try using a red shirt or some red fabric.
- Try to signal the train to stop as far away from the threat as possible so it has more time to slow down and stop.

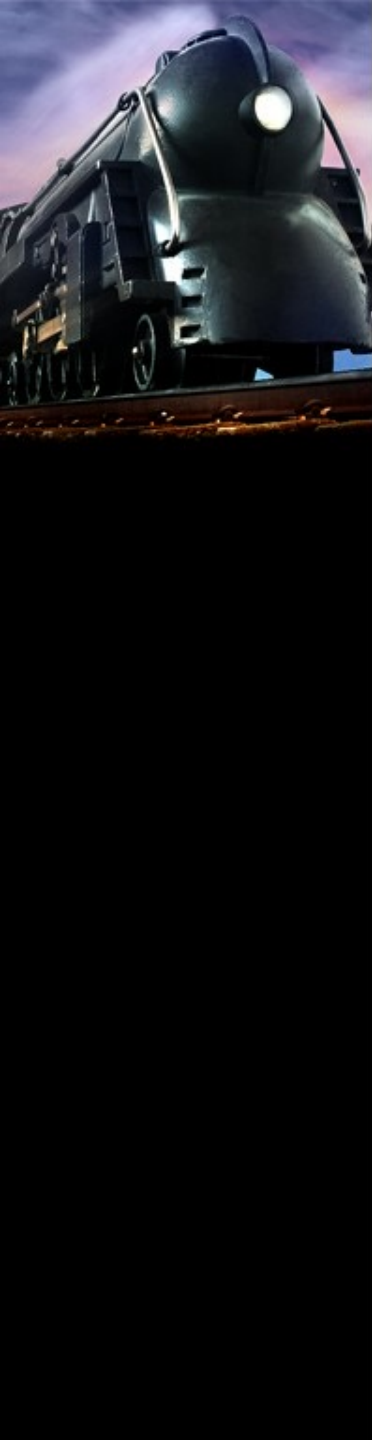




Emergency Stop

- If you don't have a flag, stand next to the tracks and face the oncoming train.
- Use your arm closest to the track to swing back and forth at a right angle to the track to signal for the train to stop.
- Keep your opposite arm still at your side.
- Use only 1 arm to signal so the message is clear.





Requirement 7



Do EACH of the following:

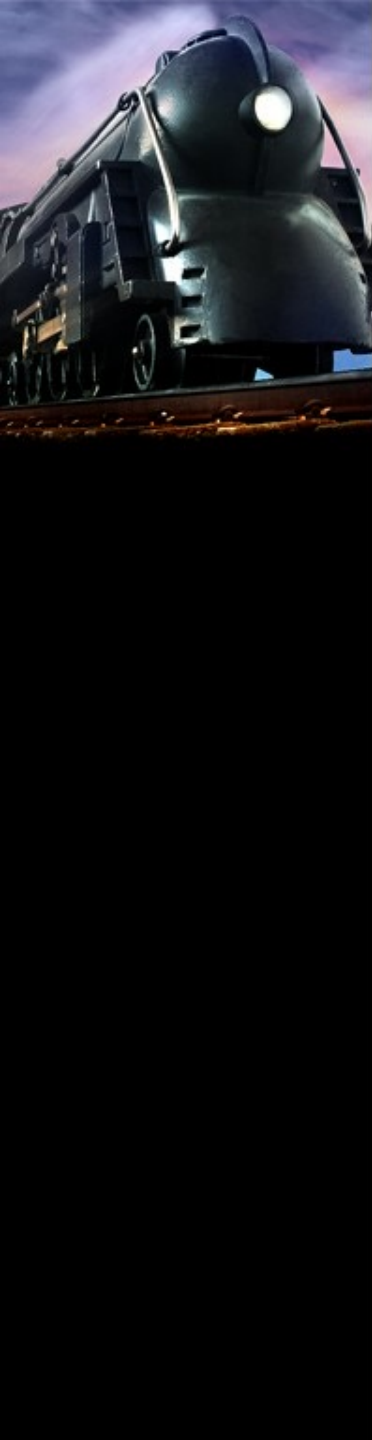
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- b. Explain the meaning of three horn signals.
- c. Describe a way to signal a train for an emergency stop.
- d. Explain the use and function of the EOTD (end-of-train device) or FRED (Flashing rear end device) used on the last car of most freight trains.



EOTDs and FREDs

- At one time all freight trains had cabooses which now have been replaced with End-of-Train-Devices (EOTDs) equipped with a bright flashing red warning light.
- These are also called Flashing-Rear-End-Devices (FREDs).
- They are always placed on the last car of a train to alert train crews by radio signal to problems detected in the air brake system.
- An engineer can also apply brakes from the rear of the train through radio contact with the EOTD.





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

a. Model Railroading

With your parent's and counselor's approval, do TWO of the following:

1. Draw a layout of your own model railroad; or one that could be built in your home. Design a point-to-point track or loop with different routings. Include one of the following: turnaround or terminal or yard or siding.
2. Build one model railroad car kit or one locomotive kit.
3. Name the scale of four popular model railroad gauges. Identify the scale of four model cars or locomotives.
4. Locate the website of four model railroad - related manufacturers or magazine publishers. Print information on their products and services and discuss the information with your counselor.
5. Build one railroad structure (from scratch or using a kit), paint and weather the structure, mount it on your layout or diorama, and make the surrounding area on a diorama scenic.
6. Alone or with others, build a model railroad or modular layout, including ballast and scenery. Make electrical connections and operate a train. Describe what you enjoyed most.
7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



Model Railroad Layout



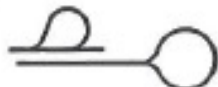
Folded dog bone
(More folds are possible.)



Oval with return cutoff;
favoring clockwise operation



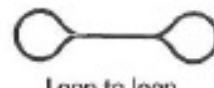
Dog bone



Return loops



Oval with two return
cutoffs; favoring
either direction



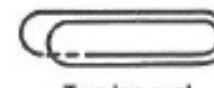
Loop to loop



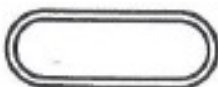
Figure eight



Oval with two return
cutoffs; favoring
either direction



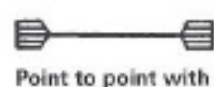
Two-lap oval



Two-track
(or double-track) oval



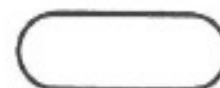
Out and back with
stub terminal



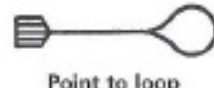
Point to point with
stub terminals



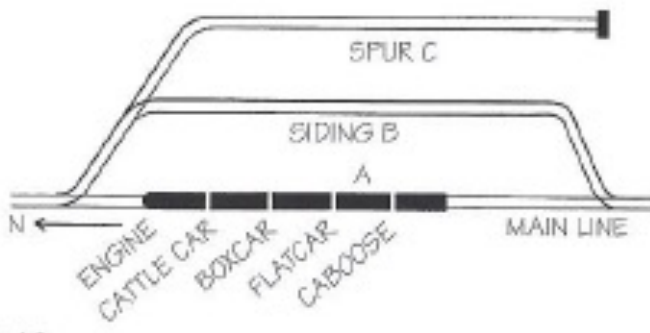
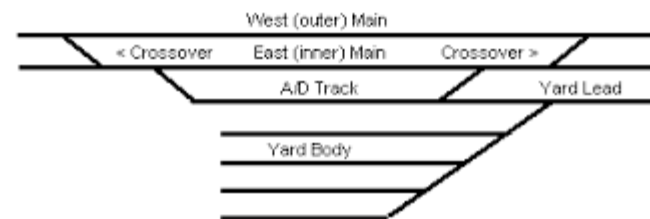
Water wings

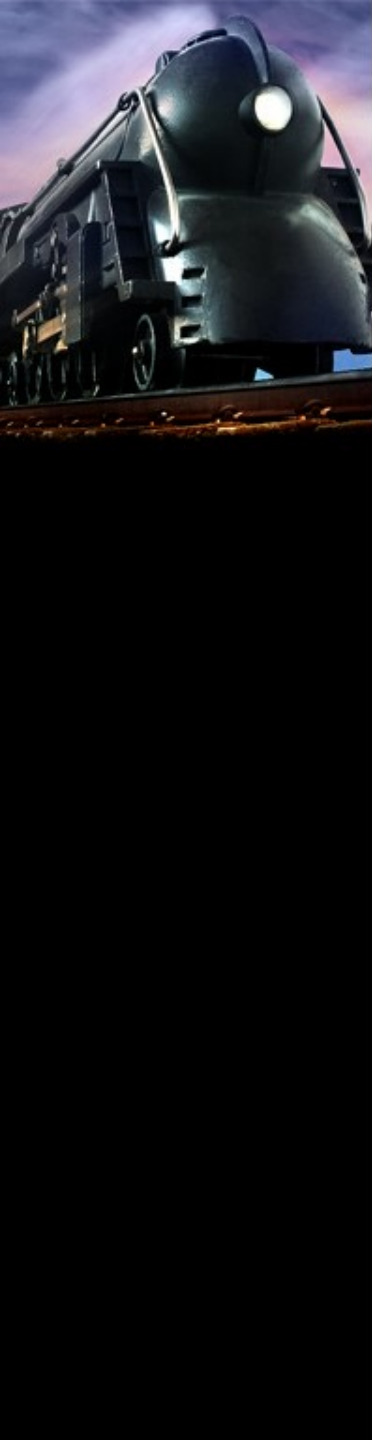


Oval



Point to loop





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

a. Model Railroading

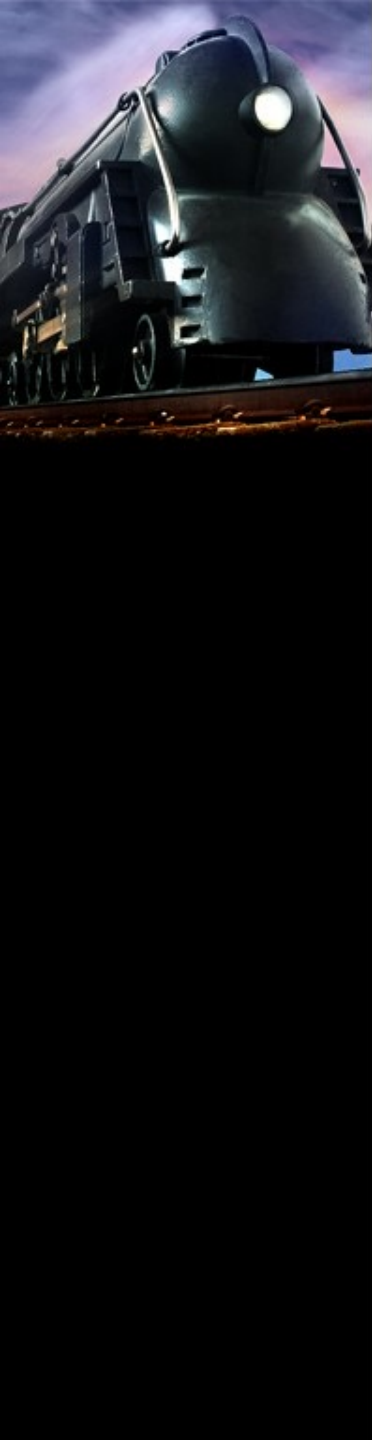
With your parent's and counselor's approval, do TWO of the following:

1. Draw a layout of your own model railroad; or one that could be built in your home. Design a point-to-point track or loop with different routings. Include one of the following: turnaround or terminal or yard or siding.
2. Build one model railroad car kit or one locomotive kit.
3. Name the scale of four popular model railroad gauges. Identify the scale of four model cars or locomotives.
4. Locate the website of four model railroad - related manufacturers or magazine publishers. Print information on their products and services and discuss the information with your counselor.
5. Build one railroad structure (from scratch or using a kit), paint and weather the structure, mount it on your layout or diorama, and make the surrounding area on a diorama scenic.
6. Alone or with others, build a model railroad or modular layout, including ballast and scenery. Make electrical connections and operate a train. Describe what you enjoyed most.
7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



Model Railroad Kits





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

a. Model Railroading

With your parent's and counselor's approval, do TWO of the following:

1. Draw a layout of your own model railroad; or one that could be built in your home. Design a point-to-point track or loop with different routings. Include one of the following: turnaround or terminal or yard or siding.
2. Build one model railroad car kit or one locomotive kit.
3. Name the scale of four popular model railroad gauges. Identify the scale of four model cars or locomotives.
4. Locate the website of four model railroad - related manufacturers or magazine publishers. Print information on their products and services and discuss the information with your counselor.
5. Build one railroad structure (from scratch or using a kit), paint and weather the structure, mount it on your layout or diorama, and make the surrounding area on a diorama scenic.
6. Alone or with others, build a model railroad or modular layout, including ballast and scenery. Make electrical connections and operate a train. Describe what you enjoyed most.
7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



G Scale Model Railroads

- The largest model trains are collectively referred to as “large scale” trains.
- These big trains often operate outdoors on what are called garden railroads, though of course they can be run indoors, as well.
- These models are offered in a range of proportions, including 1:32, 1:22.5 (called “G scale”), and 1:20, but all of them operate on Gauge 1 track, which measures 45mm between the rails.
- A 50 foot locomotive will be about 18 $\frac{3}{4}$ inches long (1:32 scale)
- An 80 foot passenger car will be about 30 inches long (1:32 scale)





O Scale Model Railroads

- The next largest popular scale is O (1:48 proportion).
- Each $\frac{1}{4}$ inch on an O scale model represents one foot on a full-size train.
- Track in O gauge measures $1\frac{1}{4}$ " between the rails.
- A 50 foot locomotive will be about $12\frac{1}{2}$ inches long
- An 80 foot passenger car will be about 20 inches long.





S Scale Model Railroads

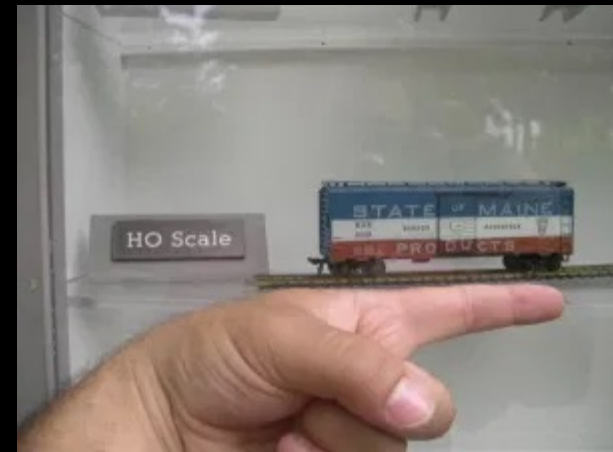
- Slightly smaller than O scale is S scale (1:64 proportion).
- These locomotives and cars run on rails spaced $7/8$ " apart.
- Unlike their toy predecessors, today's S scale models are as highly detailed as trains in other scales.
- A 50 foot locomotive will be about $9 \frac{1}{2}$ inches long
- An 80 foot passenger car will be about 15 inches long.





HO Scale Model Railroads

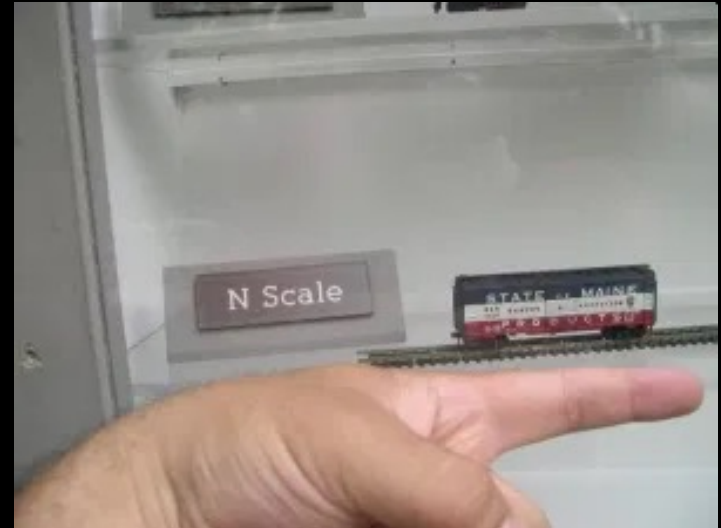
- Overshadowing the larger scales in popularity are models built to be approximately half the size of O scale models (that's why they are called "HO").
- These trains are 1/87 the size of their real-world prototypes, and HO gauge track measures 16.5mm between the rails.
- HO trains are small enough to allow a satisfying layout in a compact space (i.e. 4 x 8-foot sheet of plywood), while still being large enough to show great detail.
- HO railroading is the most popular of the scales with more than two-thirds of modelers making it their choice.
- A 50 foot locomotive will be about 7 inches long.
- An 80 foot passenger car will be about 11 inches long.





N Scale Model Railroads

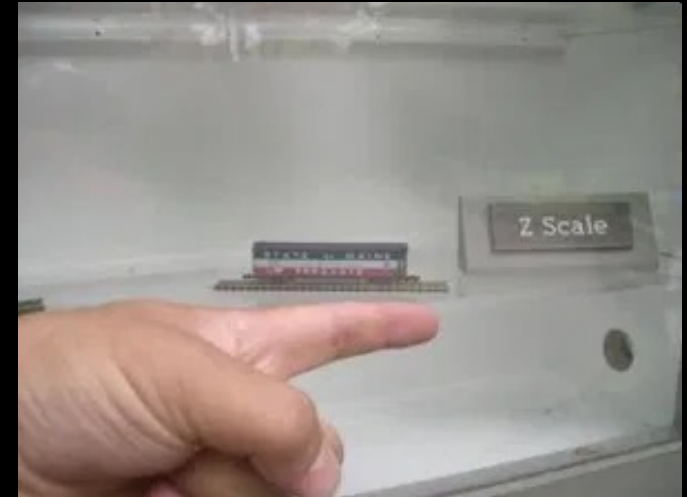
- Smaller still is N scale.
- Rolling stock and locomotives of this size are 1/160 the size of their real-life counterparts.
- The track gauge is 9mm between the rails.
- N scale works well for modelers who don't have a lot of space or who prefer to run trains through truly expansive scenery.
- A 50 foot locomotive will be about 3 $\frac{3}{4}$ inches long.
- An 80 foot passenger car will be about 6 inches long.

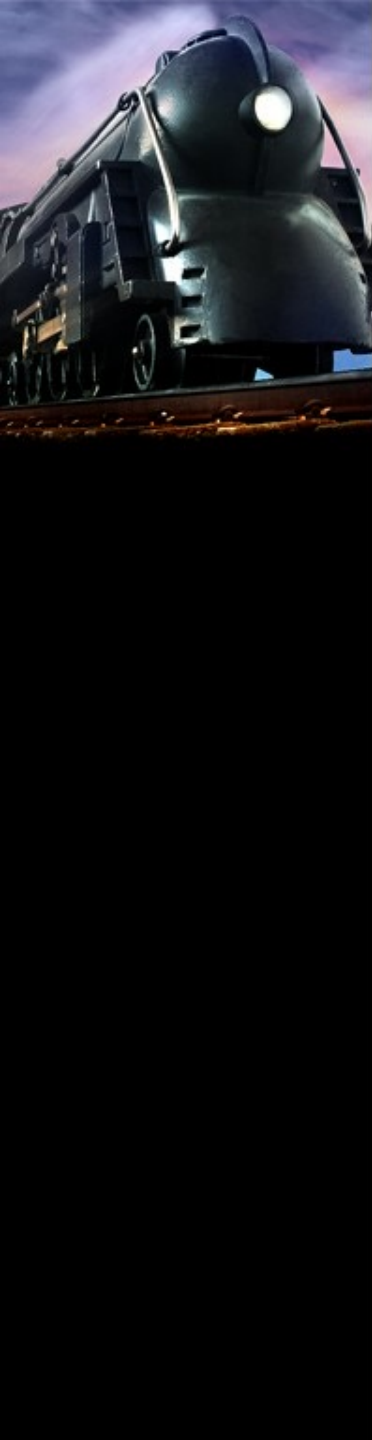




Z Scale Model Railroads

- Even smaller are Z scale trains whose proportion to the real thing is 1:220.
- They run on track whose rails are just 6.5mm apart.
- A 50 foot locomotive will be about 2 $\frac{3}{4}$ inches long.
- An 80 foot passenger car will be about 4 $\frac{1}{2}$ inches long.





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

a. Model Railroading

With your parent's and counselor's approval, do TWO of the following:

1. Draw a layout of your own model railroad; or one that could be built in your home. Design a point-to-point track or loop with different routings. Include one of the following: turnaround or terminal or yard or siding.
2. Build one model railroad car kit or one locomotive kit.
3. Name the scale of four popular model railroad gauges. Identify the scale of four model cars or locomotives.
4. **Locate the website of four model railroad - related manufacturers or magazine publishers. Print information on their products and services and discuss the information with your counselor.**
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6. Alone or with others, build a model railroad or modular layout, including ballast and scenery. Make electrical connections and operate a train. Describe what you enjoyed most.
7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



Model Railroad Manufacturer Websites

Hyperlinks to manufacturers that specialize in HO scale train sets.

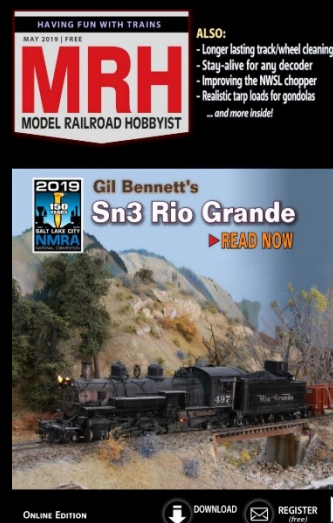
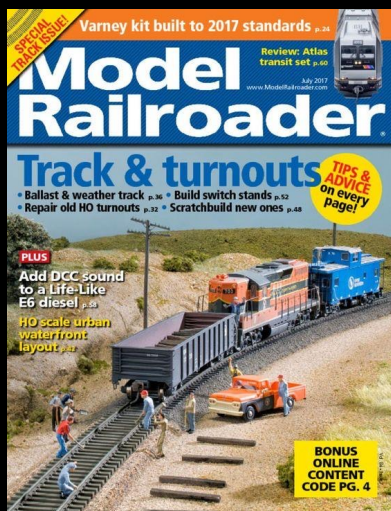
- [Athearn](#)
- [Atlas](#)
- [Bachmann](#)
- [Bowser](#)
- [Broadway Limited Imports](#)
- [Kato](#)
- [Lionel](#)
- [Model Power](#)
- [Walthers](#)

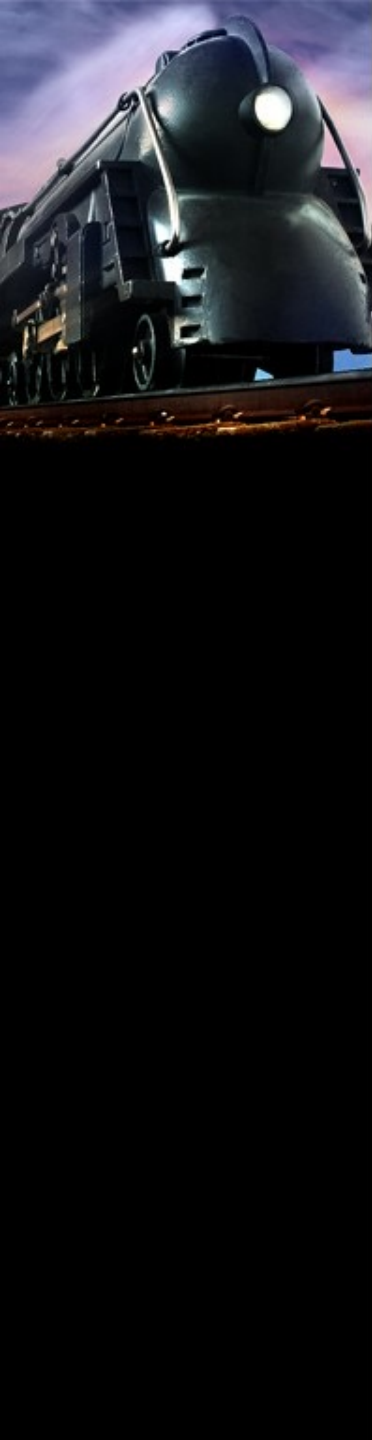




Model Railroad Magazine Websites

Click on the pictures for the websites of model railroad magazines.





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

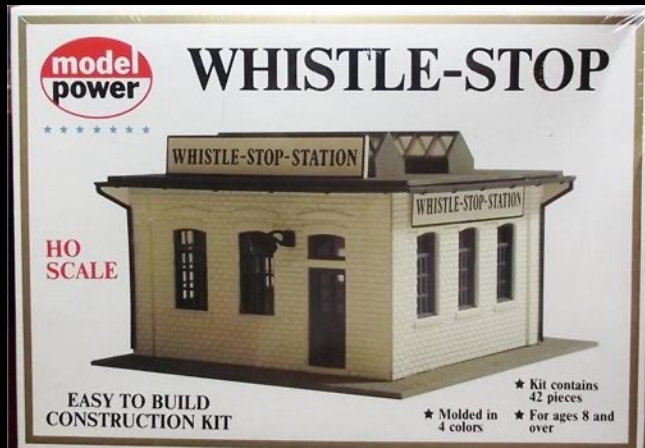
a. Model Railroading

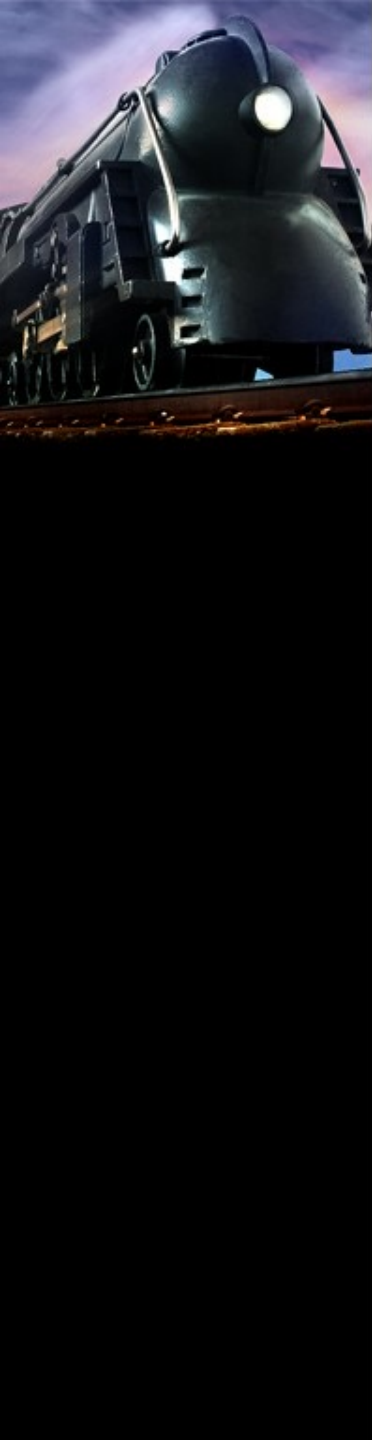
With your parent's and counselor's approval, do TWO of the following:

1. Draw a layout of your own model railroad; or one that could be built in your home. Design a point-to-point track or loop with different routings. Include one of the following: turnaround or terminal or yard or siding.
2. Build one model railroad car kit or one locomotive kit.
3. Name the scale of four popular model railroad gauges. Identify the scale of four model cars or locomotives.
4. Locate the website of four model railroad - related manufacturers or magazine publishers. Print information on their products and services and discuss the information with your counselor.
5. Build one railroad structure (from scratch or using a kit), paint and weather the structure, mount it on your layout or diorama, and make the surrounding area on a diorama scenic.
6. Alone or with others, build a model railroad or modular layout, including ballast and scenery. Make electrical connections and operate a train. Describe what you enjoyed most.
7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



Build a Model Railroad Structure





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

a. Model Railroading

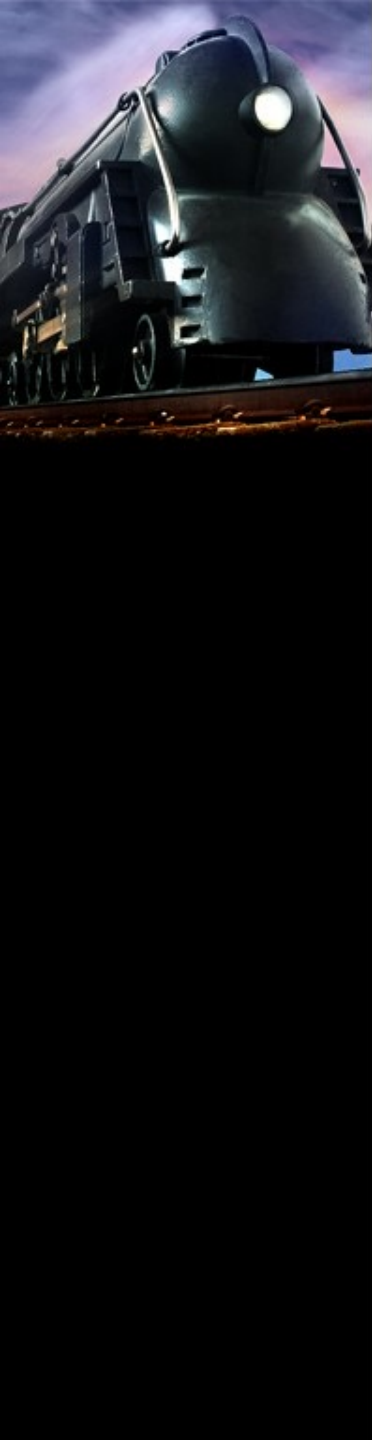
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7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



Build a Model Railroad Layout





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

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7. Participate in a switching contest on a timesaver layout and record your time.
8. Explain the difference between powering and controlling a model railroad by using direct current, and powering and controlling a model railroad using digital command control.



Switching Contest

Timesaver Description & Instructions

- The Timesaver is a small railyard layout first published as a switching game in the November 1972 issue of Model Railroader Magazine by John Allen.
- The Timesaver comprises an inbound/outbound track, four short spur tracks, and a run-around area in the middle.
- Cars are to be spotted in the yard and/or picked up from the yard.

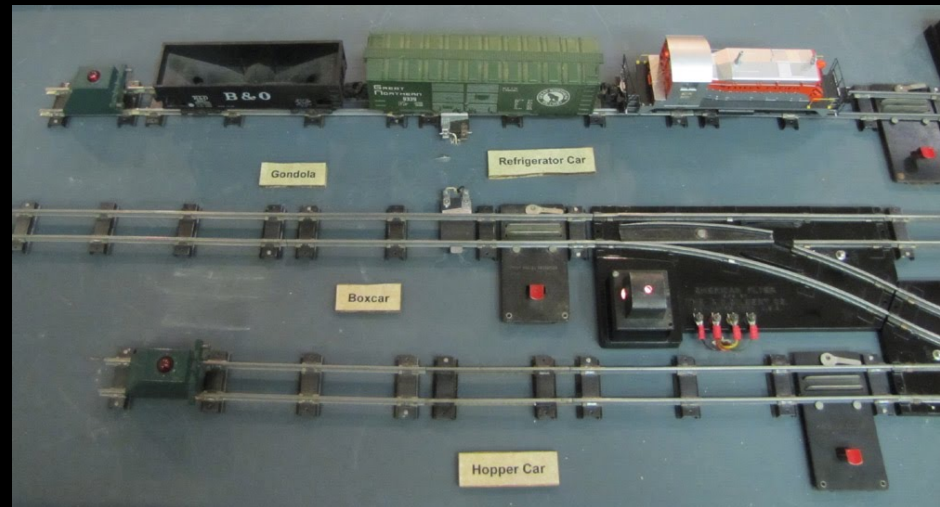




Switching Contest

Timesaver Description and Instructions

- It is generally played with five cars, but can be played with as many as nine to make it more difficult.
- It is the limited amount of space on the spur sidings and in the run-around that makes it challenging.
- At the start of the game, tiles (each bearing the name of a car) are set out to mark the ending position of each car, and hence to define the assigned switching task.
- The objective is to complete the assigned switching task as fast as you can.

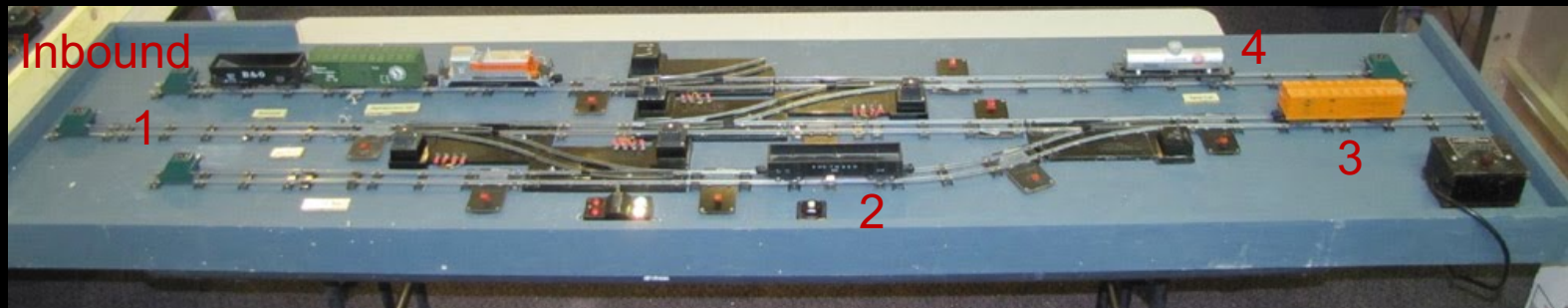




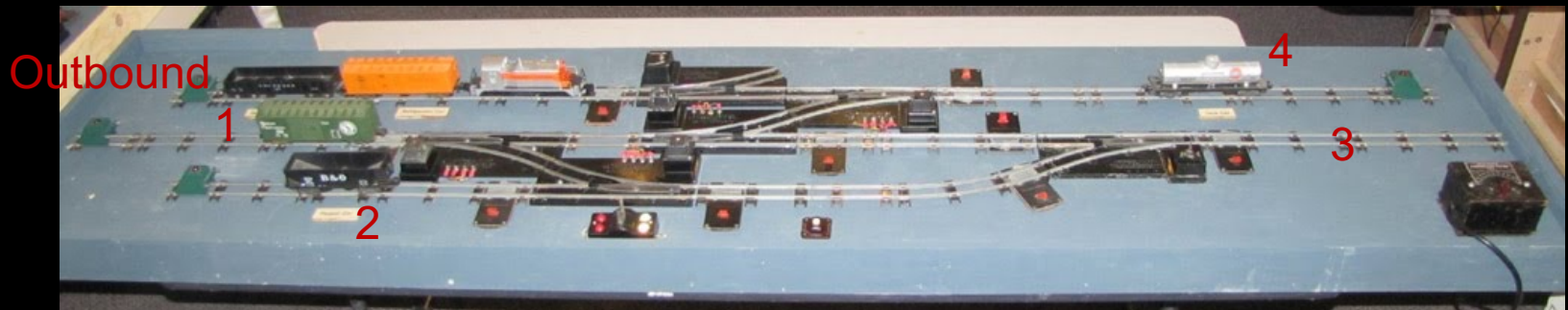
Switching Contest

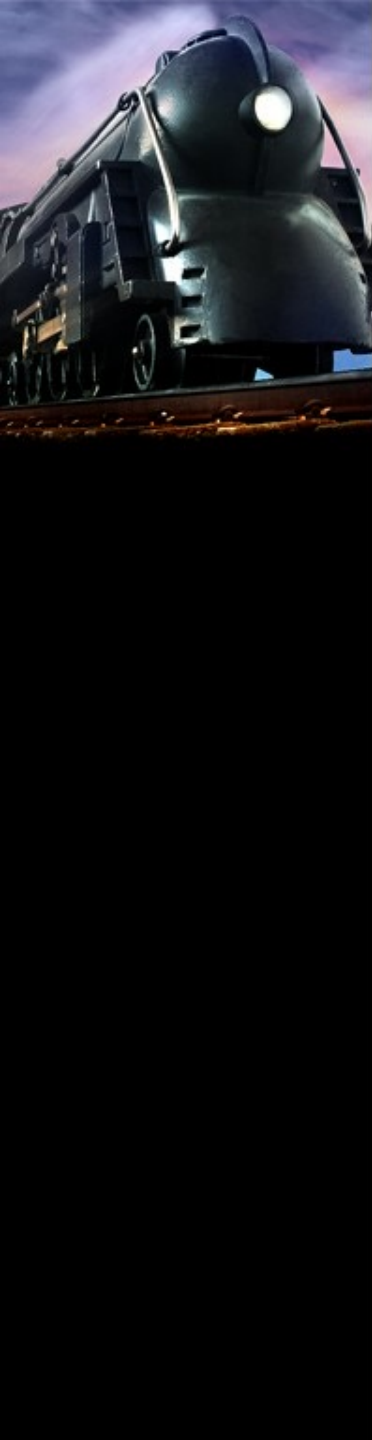
Switching Scenario

- Starting positions: On the inbound track, from left to right: hopper, boxcar, switch engine. On track 2 gondola. On track 3, refrigerator car. On track 4, tank car.



- Ending positions: On the outbound track, from left to right: gondola, refrigerator car, switch engine. On track 1, boxcar. On track 2, hopper. On track 4, tank car.





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

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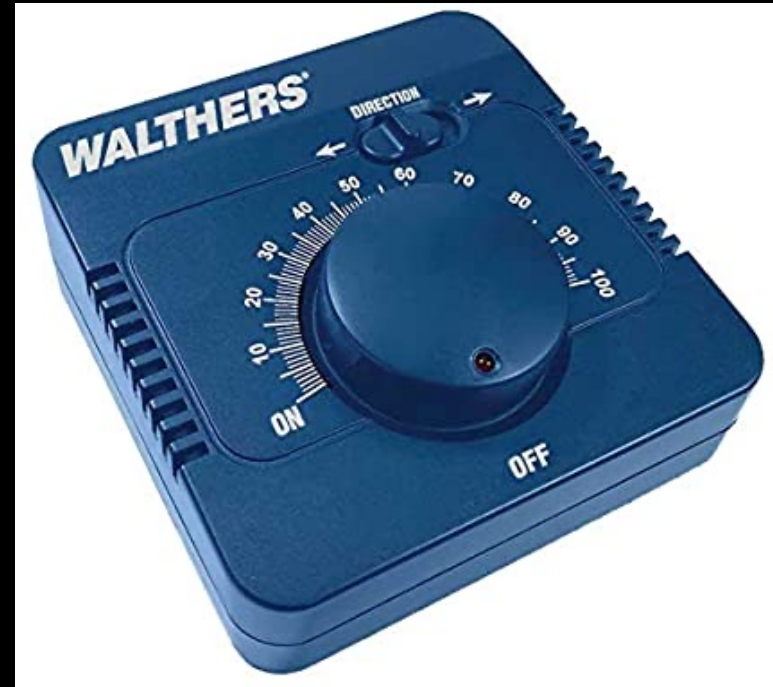
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Powering and Controlling a Model Railroad

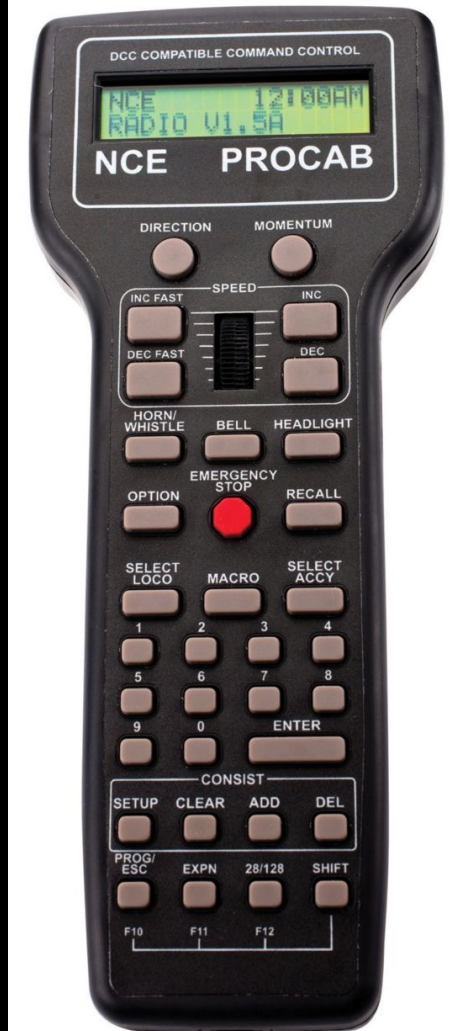
- For many years, model trains have been run by DC (direct current) power packs plugged into a wall outlet.
- Power packs include a transformer to reduce the 110 volt AC (alternating current) house voltage to about 18 volts before a rectifier in the circuit converts it to 12 volts DC.
- A rheostat adds variable resistance to the circuit to control the voltage (speed) while the DC polarity determines the train's direction.
- In DC control systems you control the track, not the trains. All trains on the track will respond the same. Two trains on the same track will move in the same direction, stop, start, speed up and slow down at the same time.

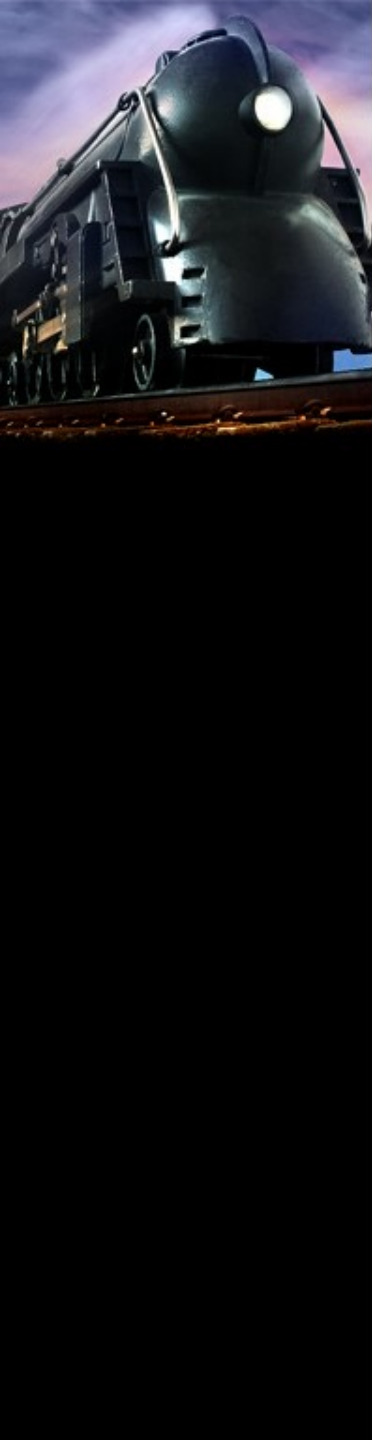




Powering and Controlling a Model Railroad

- Digital Command Control (DCC) is a relatively new system for controlling model trains with simplified wiring.
- Each locomotive contains a decoder that can be linked to a specific throttle control through the system's minicomputer.
- Throttle settings and other commands from the control are broadcast as high-speed digital signals that travel through the entire layout.
- The locomotive's decoder responds only to signals from its assigned control to operate the locomotive.
- DCC allows many locomotives to operate under individual control at the same time on a layout.





Requirement 8



Select ONE of the following special-interest areas and complete the requirements:

b. Railfanning

With your parent's and counselor's approval, do TWO of the following:

1. Visit a railroad museum, historical display, or a prototype railroad-sponsored public event. With permission, photograph, videotape, or sketch items of interest. Explain what you saw and describe your photos, sketches, or videotape.
2. Purchase tickets and ride a scenic or historic railroad. Under supervision, photograph the equipment and discuss with your counselor the historic significance of the operation.
3. Locate the website of four rail historical groups, then find information on the history of the rail preservation operations and purpose of each group. Talk with a member of one of the groups and find out how you might help.
4. Plan a trip by rail between two points. Obtain a schedule and explain when the train should arrive at two intermediate points. Purchase the tickets and make the trip. Explain to your counselor what you saw.



Railroad Museums and Displays

- **Toledo Lake Erie & Western Railway and Museum**

17475 Saylor Ln.

Grand Rapids, Ohio 43522

(419) 878-2177

tlewtraininfo@yahoo.com



- **Northwest Ohio Railroad Preservation**

12505 C.R. 99

Findlay, Ohio 45840

419-423-2995

nworrrp@nworrrp.org



- **Mad River & NKP Railroad Museum**

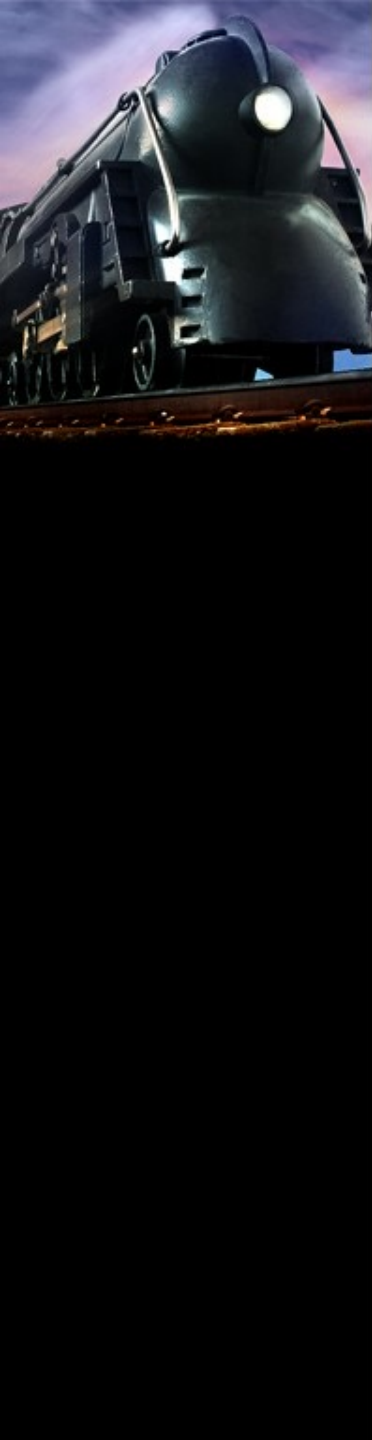
253 Southwest Street

Bellevue, Ohio 44811

(419) 483-2222

madriver@onebellevue.com





Requirement 8



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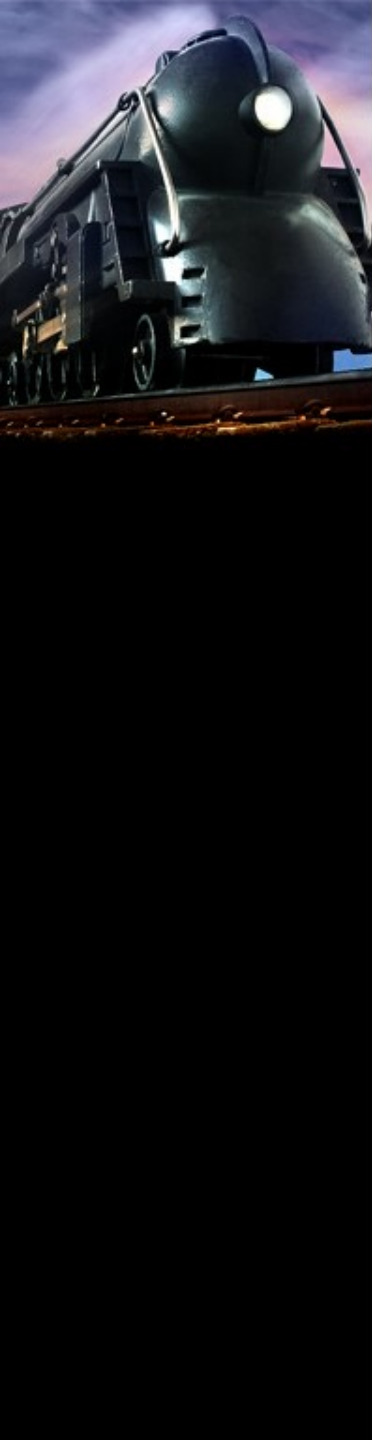
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Historic Railroads

Click on the pictures to the right for information on historical railroads you can ride.





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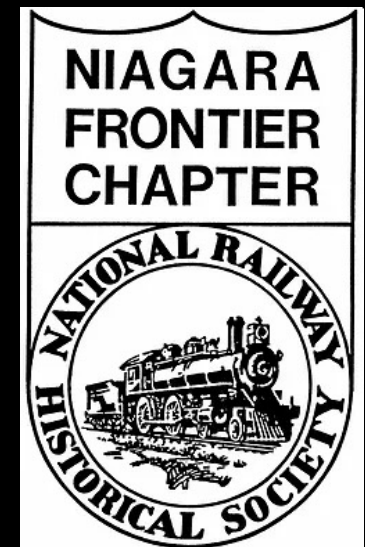
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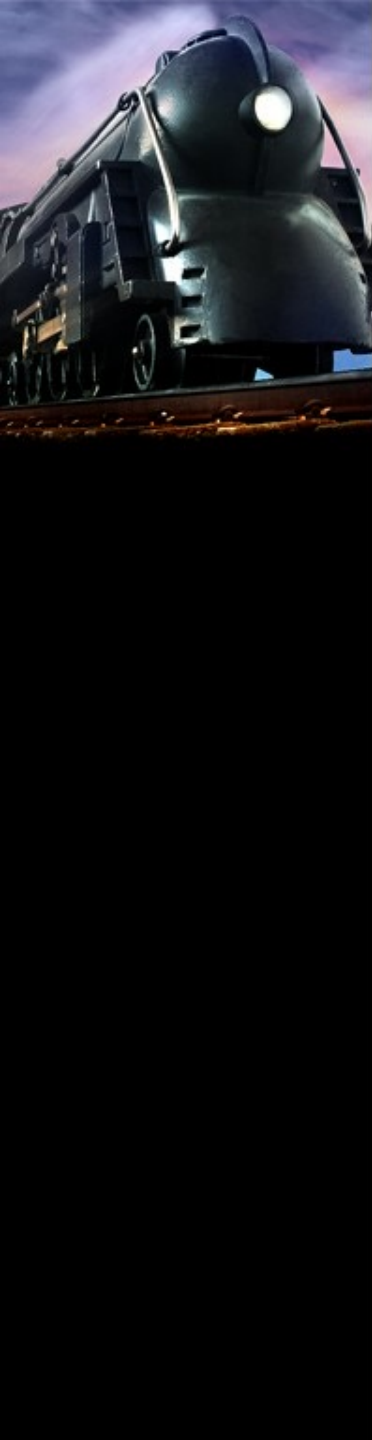
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Websites Of Rail Historical Groups

Click on the logos below for the websites of Rail Historical Groups.





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Travelling by Rail

Click on the logo for information on passenger rail schedules and ticket purchasing.

