

# Railroading Merit Badge



# 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.



# 1b. Class 1 Railroads

- Amtrak (Passenger) 1971
- BNSF Railway 1995
- Canadian National's operations (CN) 1919
- Canadian Pacific (CP) 1881
- Kansas City Southern (KCS) 1887
- Norfolk Southern (NS) 1982
- Union Pacific Railroad (UP) 1862



# 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).
  - Alaska Railroad
  - Florida East Coast Railway
  - Great Lakes Central Railroad
  - San Joaquin Valley Railroad
  - Wisconsin and Southern Railroad



# 1c. Railcars

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



# 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.



TTX Flatcar 25369 w/OG Trailers  
Cosair, TN March 1977

# 1c. Railcars

**Authorack**, 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.

Caboose 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.

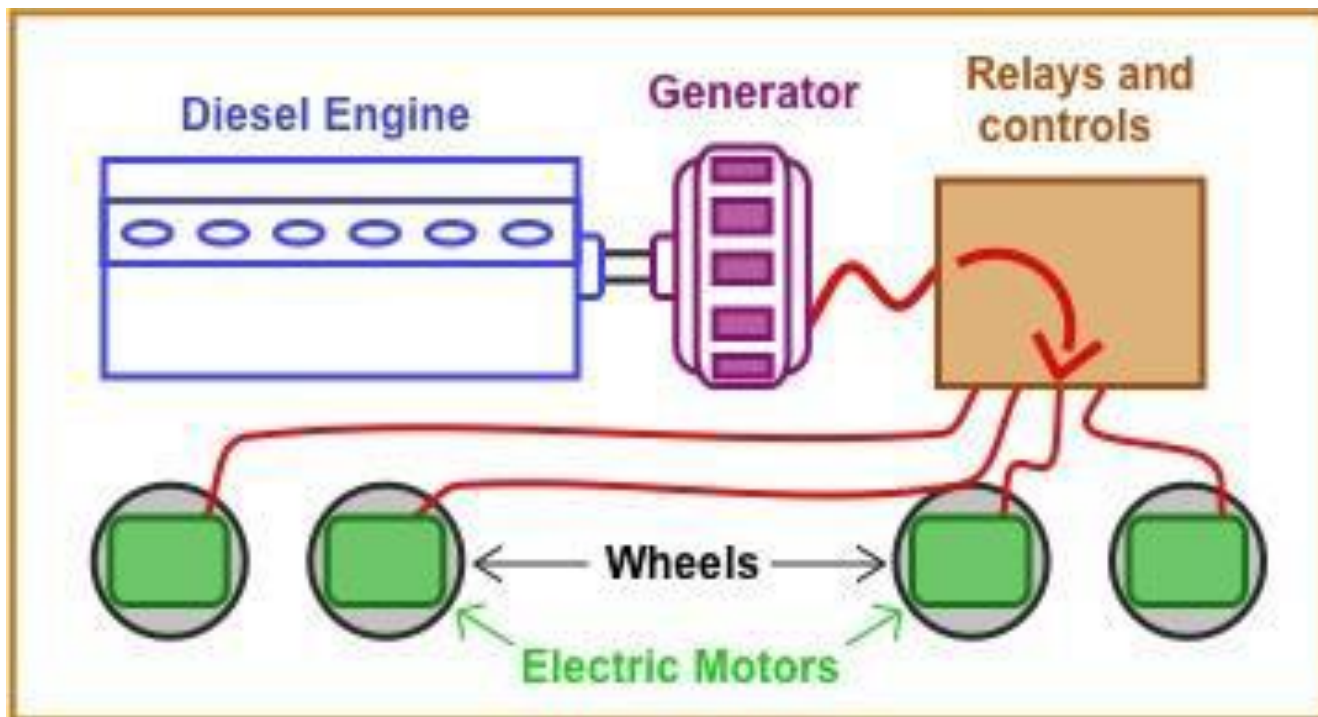
The term passenger car can also be associated with a sleeping car, a baggage car, a dining car, railway post office and prisoner transport cars.



# 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.

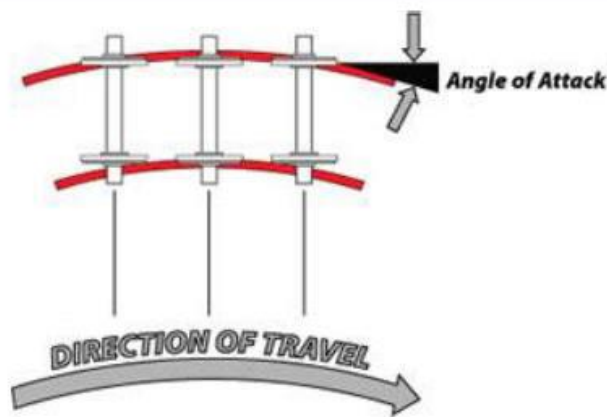
# 1d. Radial Steering Trucks

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.

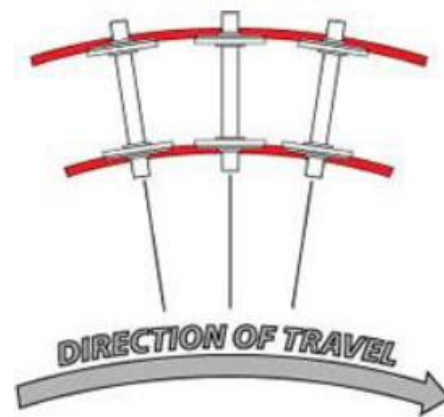
These trucks reduce wheel and track wear and provide better adhesion.

*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.

## 2a 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.

# 2a Plan a 500 mile trip by train

<https://www.amtrak.com/home.html>

- 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?)

## 2b 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.



## 2b 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.



## 2b 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.



## 2b 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.





## 2b 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.



# 3a 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.

# 3b 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

# 3c Rail Support Industries

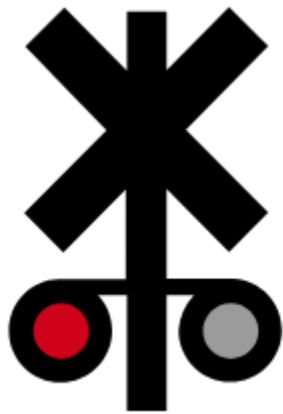
- The Herzog Companies provide temporary services that can help supplement the workforce of a railroad.
- LORAM makes special equipment for railroads
- Railworks specializes in track building, in North America. This includes restoration of existing tracks, installing new tracks, and even things that 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.
- Freight Car 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.

## 3d Interview railroad employee

- 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.

# Operation Lifesaver

4a. 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®**

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**Rail Safety Education**

## 4b. 9 track basic safety tips when you are around a track

1. Trains do not run on set schedules. They can be on any track, at any time, going in either direction
2. Always yield the right of way to the train. The train cannot yield to you.
3. Never ignore active warnings at crossings.
4. Trains will arrive at a crossing faster than you anticipate.
5. Look and listen when you see advance warning signs indicating a rail-highway crossing.
6. Don't get trapped on railroad crossings.
7. Before starting across the tracks, be sure there's room to get completely across.
8. When running away from a vehicle stuck on tracks, run away from the tracks at an angle in the direction of the approaching train.
9. When crossing has more than one track, don't try to cross immediately after the end of the train passes -- there may be another train approaching on the second track.
10. Stay off railroad property and stay safe.

## 4c 9 safety considerations when walking near a track

1. Don't play near trains or tracks; pushing and shoving can cause accidents.
2. Remember to obey all warning signs and signals.
3. Never cross train tracks to get to a platform. Use marked pathways and stairways to get from platform to platform.
4. 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.
5. Always stay behind the yellow lines at train stations. Enter or exit a station platform at designated areas.
6. Use care when climbing the steps to your rail car. Hold onto the railing and pay attention to where you walk.
7. If you need to move between cars, be aware that gaps may present a trip hazard.
8. When boarding train, familiarize yourself with the safety information and emergency procedures on the safety card found in most seat backs.
9. 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.
10. Never attempt to board or exit a moving train.
11. Avoid walking along tracks, especially while wearing earphones.
12. Avoid fishing or diving from a railroad bridge or trestle.
13. Take an alternate route instead of walking through tunnels, which allow very little clearance.
14. Resist the temptation to place items on tracks –even coins to be flattened.
15. Leave railroad switches alone.
16. Stay away from rolling stock such as sidelined cars, track maintenance equipment, piles of ties, ballast, or stacked rail.



## 4d What can drivers do to safely operate near tracks

- 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.

4e Explain safety precautions when using a light rail or commuter train

- **STAND BACK.** Observe the pavement markings
- **STAY OFF THE TRACKS.** If you drop an item on the tracks, do not attempt to retrieve it.
- **SEE TRACKS? THINK TRAIN**
- **BE AWARE OF HIGH VOLTAGE**
- **CROSS LEGALLY AND SAFELY**
- **WAIT, LOOK BOTH WAYS**

# 5a Passive signs



## 5b Active 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.



## 5b Active 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.



# 5c markings on the road

- Always follow markings on the road.



# 5d Advanced signs

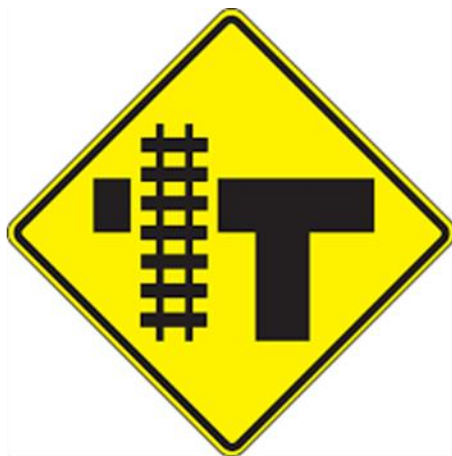


# 5e signs along railroad property





# 5f Signs at the crossing



# 6a railroad signal operation

- Green - Used to indicate "clear" or proceed.
- Yellow - Used to warn the engineer of an impending stop or speed reduction for an occupied "block" ahead. Also used for low-speed movements.
- Red - Used to indicate a full stop or other restrictive condition, or used as a "placeholder" light (when that part of a signal is unused but to confirm to the crew the signal is working, so as not to require guessing the rest of the combination in case of a light failure).



# 6b Horn signals

- 1 short blast
  - Stopped- Apply brakes or wheel chocks.
- 2 short blasts
  - Start - Indicates the intention to start a standing train
- 3 short blasts
  - Back - Indicates the intention to back up a standing train
- 2 longs, 1 short and 1 long
  - the final long being held until the train has entered the crossing
  - Grade Crossing - Sound signal when approaching public crossings (roads, streets or walkways).

# 6c emergency stop signal

- Waving a red flag
- Hold up both hands



## 6d EOTD/FRED

- EOTD (end-of-train device) replaces the caboose
- FRED (flashing rear end device), used on the last car of most freight trains.



## Part 2 Railfanning (Do Two of the following)

1. Visit a railroad museum, historical display, or a prototype railroad-sponsored public event. With permission, photograph, digitally record, or sketch items of interest. Explain what you saw and describe your photos, sketches, or video.
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.