INFRASTRUCTURE RENEWAL
NY Penn Station

A Guide to Key Railroad Terminology for the Northeast Corridor

Index of terms

Engineering disciplines

Track: responsible for the construction and maintenance of track and right of way, including ***track structure*, *ballast*, and *subgrade***.

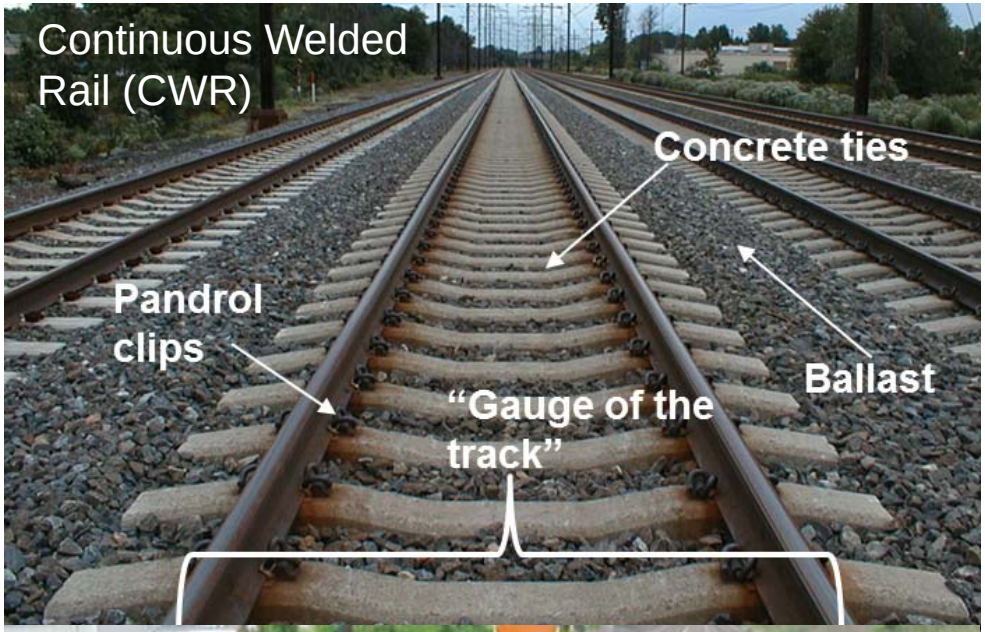
Bridges & Buildings (B&B): responsible for structures of all kinds, including tunnels, stations, bridges, and carpentry.

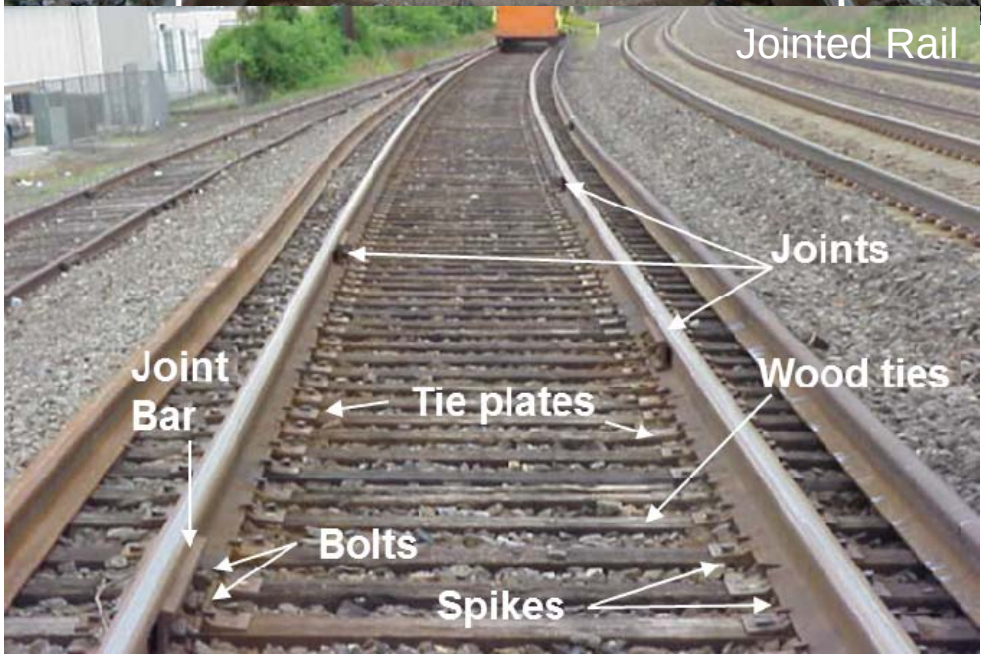
Communications & Signals (C&S): responsible for signal systems, radio and other communications functions.

Electric Traction (ET): responsible *for* ***catenary, third rail*** and ***substation*** systems maintenance and repair. Also provides a dedicated signal power system used with the C&S department.

Because of the integrated nature of the railroad environment, many projects involve aspects of multiple disciplines.

Track





Key Terms

Ballast: Permeable layer of crushed rock that supports the track, holds it in place, and spreads out the load; rests on ***subballast*** of gravel and earthen ***subgrade.***

Gauge of the track: the space between the rails, roughly 56.5 inches but can differ slightly depending on the track class.

Joint: Point where two rails are held together by pairs of ***joint bars*****,** fastened to each other through holes drilled in the rail by ***bolts*****.**

Pandrol Clips: fasteners that connect concrete ties to rail; named for manufacturer.

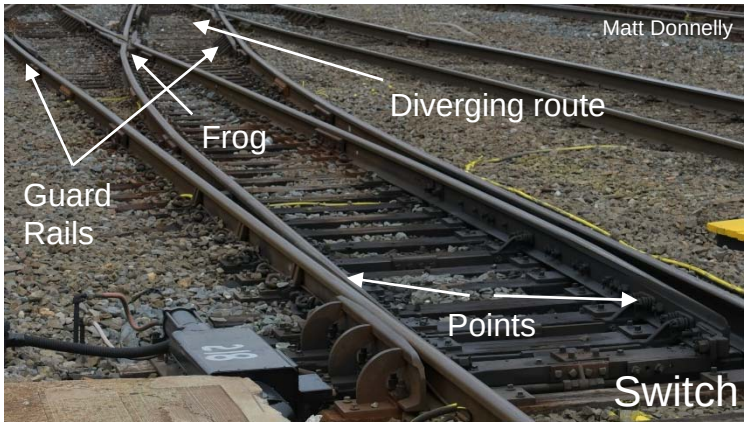
Spikes: used to hold ***rail*** in place on wooden ***ties***

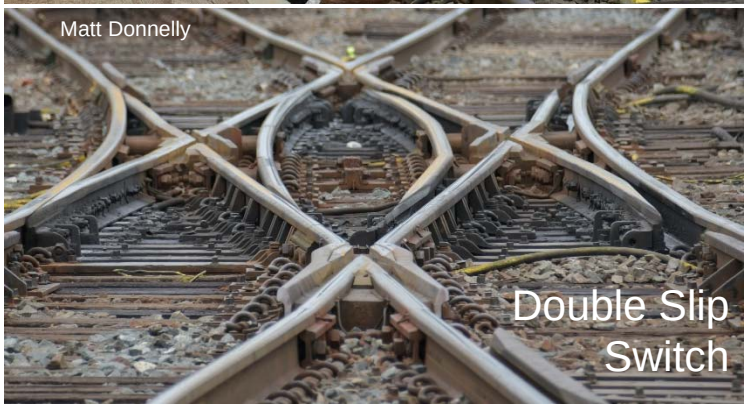
Super Elevation: Raising of the outer rail on a curve, to compensate for ***centrifugal*** (outward-pushing) ***force*****.**

Ties: Wood or concrete supports used to carry the rail and hold it ***in gauge*** (correct alignment).

Tie plates: Metal plates placed between the rail and tie, with holes for spikes. Helps to distribute load and reduce wear on wood ties.

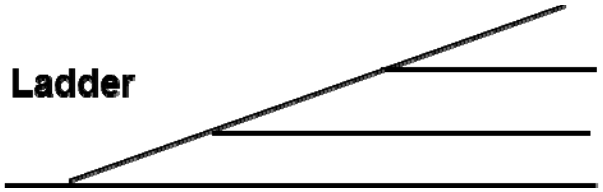
Switch (Also known as “Turnout”)





- Switches are used to control train movement and routing. To move trains from one track to another. These can be controlled by air power, electrical power, pneumatic power or hand power.
- Ordinary switches have two positions, ***normal*** (straight ahead) or ***reversed*** (for a ***diverging*** route)
- **Key components:**
  - ***Frogs*** allow the flanges (raised lip) on the inside of the wheels to cross rails.
  - ***Points*** are the beveled rails that move back and forth on command to control routing between ***normal*** (usually straight ahead) and ***diverging*** routes.
  - ***Guard rails*** are installed at certain points to keep wheels in line with track in the event of a derailment.
- ***Double slip*** switches (common in major terminals) allow up to four routings.
- An area of interconnected controlled switches and signals is an ***interlocking.***

Track configuration terms



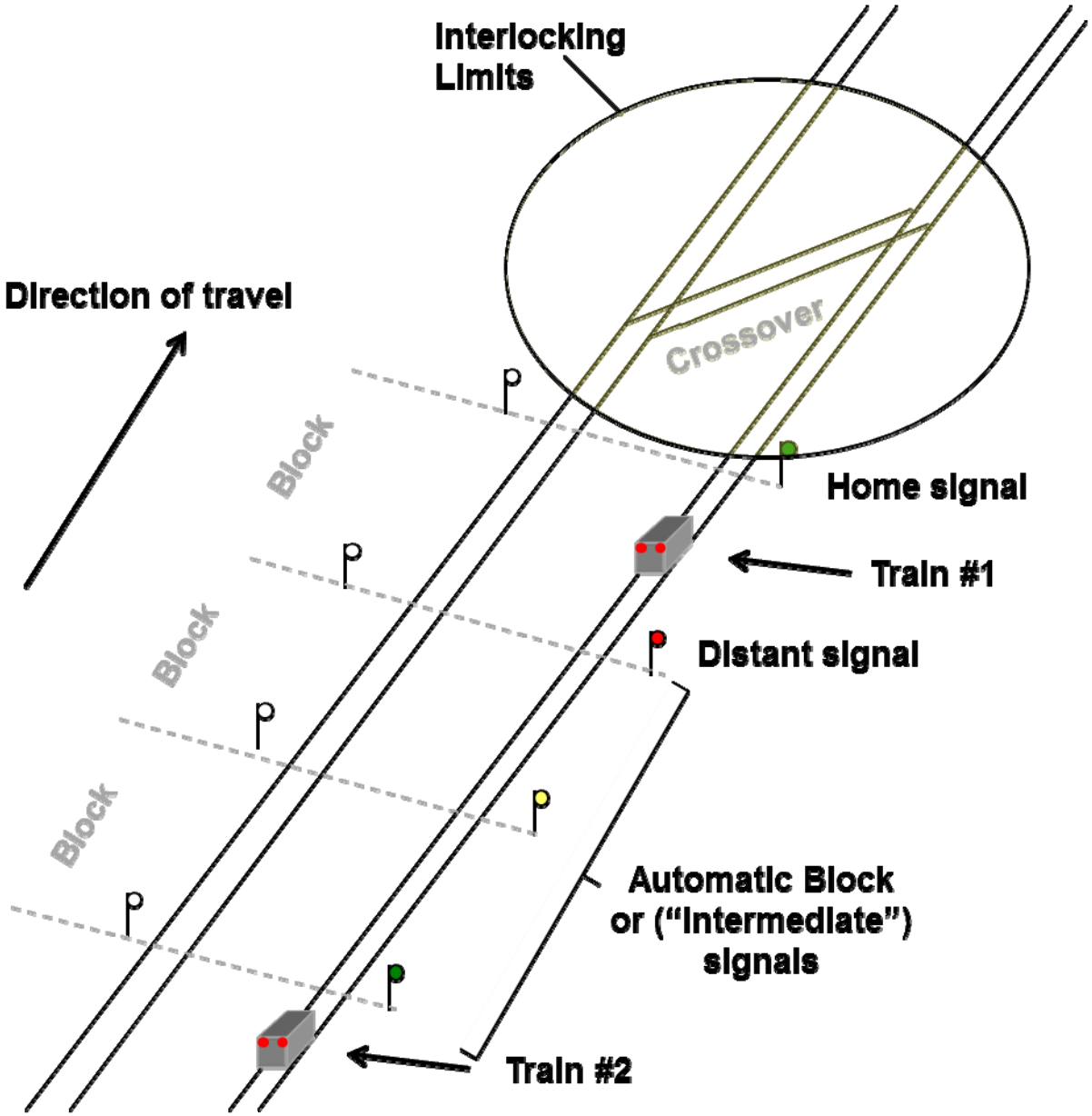
- ***Crossovers*** are switches connecting two parallel tracks.
- A ***Railroad crossing*** is the intersection of two tracks.
- A ***Grade crossing*** is where a public road crosses the railroad.
- A ***ladder*** is a track with a series of switches which provides access to any of several parallel tracks.
  - Typically found in yards and terminals.
- An ***'X' crossing*** is a universal crossover with a crossing in the middle, typically used in confined spaces. This is usually a double slip switch (as found in New York Penn Station).
- A ***Scissor crossing*** is another term for an X crossing.

The addition of signals and controlling *logic* makes any of these a component of an *interlocking.*

Maintenance of Way terms

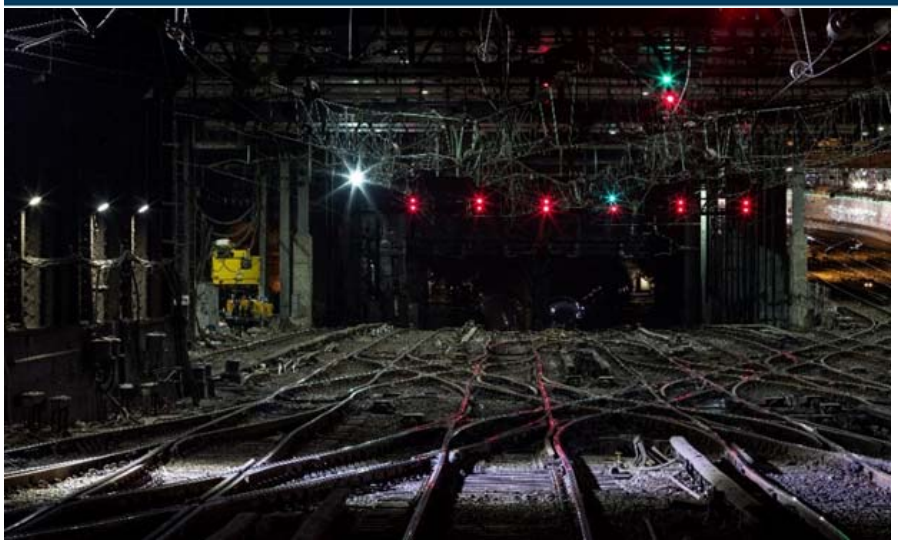
- **Maintenance of way:** the repair and sustainment of track, roadbed, and associated structures such as bridges and tunnels.
- **Mud spots:** places in the ballast where mud has accumulated over time, reducing the permeability and changing the performance of the track under trains. Mud can be dealt with by ***undercutting*** of ballast with special trains.
- **Rail Grinding:** friction process used to restore the profile of worn rail, extending its service life.
- **Slow orders:** Instructions issued by ***dispatchers,*** usually at the request of maintenance of way staff, to restrict speeds over specified segments of track; work in progress or deterioration of track condition are two possible reasons for issuance of slow orders.
- **Surfacing:** the lifting of track so that new layers of ***ballast*** can be added, then ***tamped,*** and shaped to the contour necessary for a smooth ride.
- **Switch replacement**- the wholesale removal and substitution of a ***switch*** or ***turnout.*** In most cases, this is done by building a ***panel*** (a finished segment of track, in this context a switch, complete with rails, ties, frog and other essential components), lowering it into place after the existing switch has been removed, and connecting it to the rails.
- **Tamping:** Compacting of ballast under ties can be done by hand, or with a special rail car called a ***tamper.*** Tamping is designed to solidify the ballast beneath the track, ensuring uniform resistance to the loads of passing trains and a comfortable ride.
- **Tie replacement:** the removal of deteriorating ties, and replacement with new ones. Typically accomplished in one of two ways:
  - ***Track Laying Machines (TLMs)*** are special trains used to undertake mass mechanized replacement of concrete ties over long stretches of track.
  - ***Spot replacement*** is the hand removal and replacement of individual ties, either concrete or wood. Because it is less efficient it is not the preferred method, but must sometimes be resorted to for individual cases of deterioration, or in spots where TLMs cannot be effectively used (either because of traffic levels or because the segment to be replaced is too short).
- **Undercutting:** Process whereby ballast is scooped out beneath track, vacuumed up and cleaned, and returned to the roadbed, which is realigned to ensure a smooth surface and correct profile.

Signal systems



- Are either ***Controlled*** or ***Automatic***:
  - ***Automatic***, often referred to as "ABS", short for "automatic block signal system"
  - ***Distant signals*** are the automatic signal in advance of the home signal.
  - ***Controlled,*** classified as Interlocking, control point, or home signals depending on their location and function.
- Automatic Signals:
  - Display a ***stop and proceed*** signal when train enters the block
  - Display an ***approach*** (*proceed prepared to stop at next signal*) behind the train after it leaves the block
  - Signals progressively upgrade as the train progresses ahead
- Controlled Signals:
  - Controlled by either the ***Dispatchers*** at CETC, or the ***Block operators*** at lineside towers
  - ***Home signals*** govern entry into, and out of the ***Interlocking.***
  - ***The Interlocking limits*** are defined as the area between opposing home signals

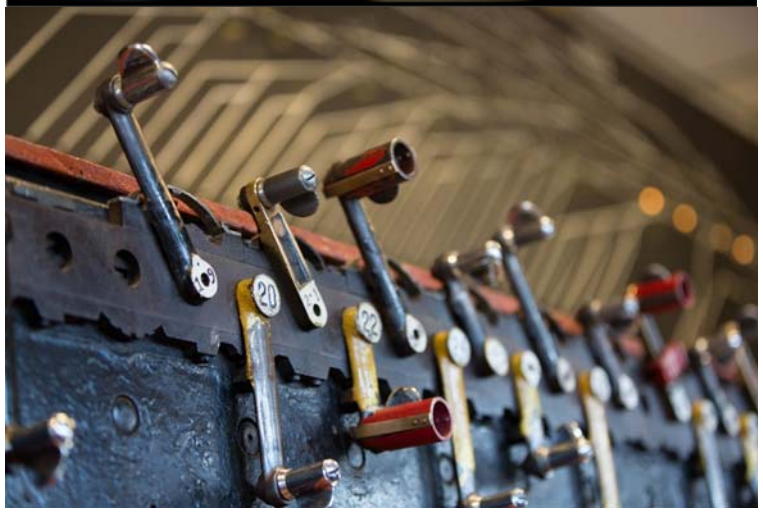
Interlockings



"A" Interlocking in New York Penn – signals displaying green over red indicate "Clear," and show a ***route*** has been ***lined*** through the interlocking

- An interconnection of signals and switches or drawbridges controlled by a ***dispatcher*** or ***block operator***
  - Called an interlocking because the machine (now mostly computers) is interconnected to prevent ***lining*** of an unsafe route (such as a train facing another train).
- Can be as simple as one crossover, or as complicated as New York Penn Station (which contains multiple interlockings).
- Also known as ***Controlled Point*** **(or "CP").**
  - A CP is a controlled signal or signals without any interlocking appliances (switches or bridges)
- Unlike automatic signals, controlled signals can be set to "Stop" (the most restrictive aspect typically displayed by an Automatic Signal is "Stop and Proceed."

Control systems



Modelboard and interlocking machine

- ***Dispatchers*** use computerized ***Centralized Traffic & Electrification Control (CETC)*** **systems** to control train movement over most of the NEC.
- ***Power Directors*** allocate electrical power through substations to operate trains.
- ***Block operators*** use ***modelboards*** and ***interlocking machines*** to control train movement through interlockings.

Electric Traction system (or “Electrification”)

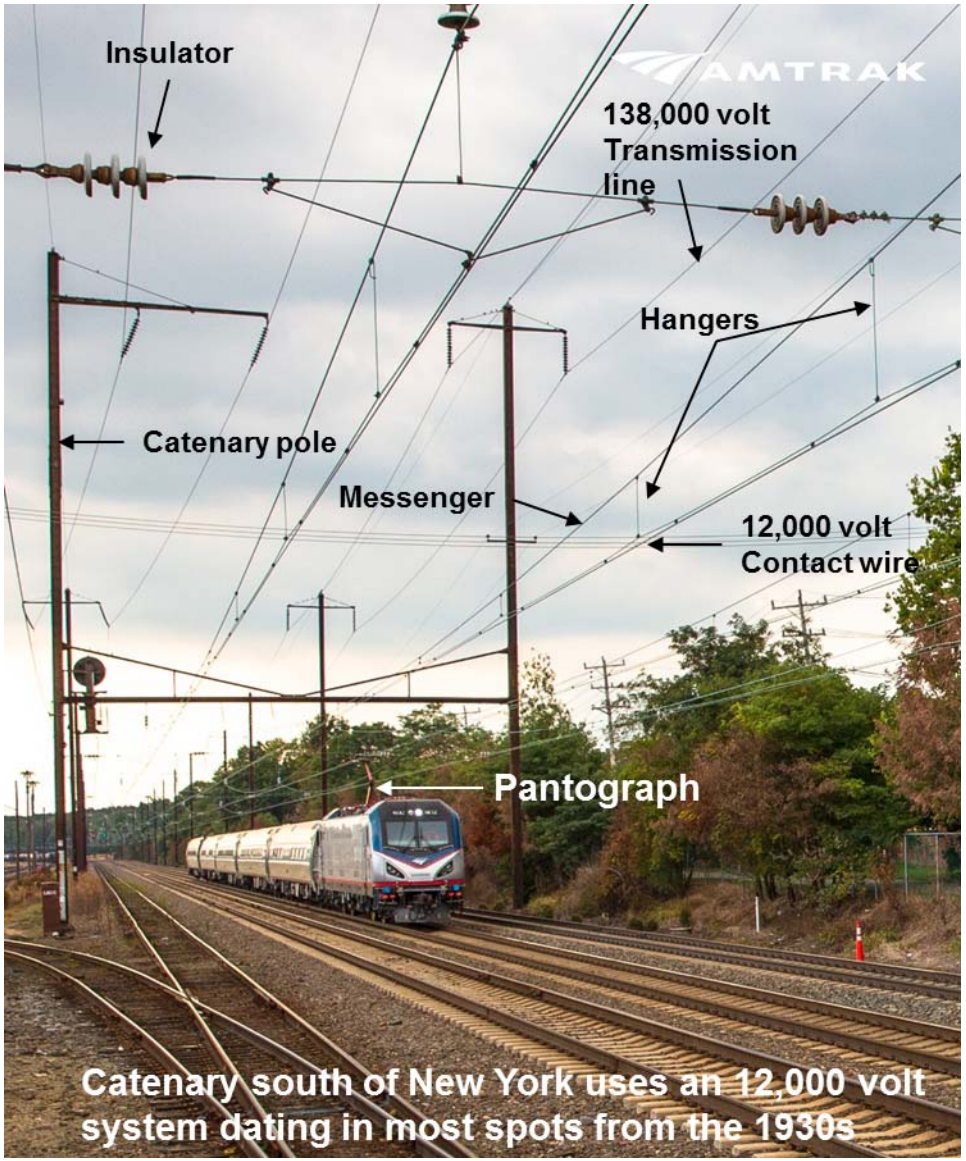
Catenary north of New Haven uses a 25,000 volt system dating from the late 1990s.

- On electrified railroads, the ***electric traction*** system is used to transmit power from a source to ***motors*** (not technically locomotives), which move trains.
- For railroad use, electric power must be**:**
  - **Generated:** usually by converting some other form of energy into electricity (thermal, hydroelectric, nuclear)
  - **Transmitted:** Power is best sent along ***transmission lines*** at very high voltages (138kv).
  - **Transformed:** to a lower voltage at a lineside ***substation.***
  - **Distributed:** to trains through a distribution system of some type, including:
    - ***Catenary***: an overhead wire system.
    - ***Third rail***: at trackside (Third rail installations at New York Penn Station accommodate LIRR trains).

Electrical systems

- Electrical substations are located at 15-20 mile intervals along electrified right-of-way.
- Spacing is designed to minimize ***line loss*** (drop in electrical power that is an inherent problem in transmission over long distances).
- ***Substations*** perform several key functions:
  - ***Transform*** power from the higher voltages used on transmission lines to voltages suitable for train operation.
  - ***Switch*** power from one segment of the catenary to another.
- ***Section breaks*** separate electrical circuits.

Catenary System



- The ***catenary system*** carries electric power used to:
  - Propel trains.
  - Operate the signal system.
- ***Catenary*** is used loosely to refer to both the suspension system and the energized electrical line (the ***contact wire***) that carries power for trains.
- A ***pantograph*** is a mechanical arm on the locomotive that contacts the ***Contact wire*** and transmits electricity to the locomotive.
- A ***section break*** (not shown) is a location designed to provide a separation of circuits. It is used to isolate a section and/or reroute power.
- ***Insulators*** are made of material that does not conduct electricity. They are used to isolate the catenary system so poles and bridges don't become electrified.