

Shinkansen Bullet Train



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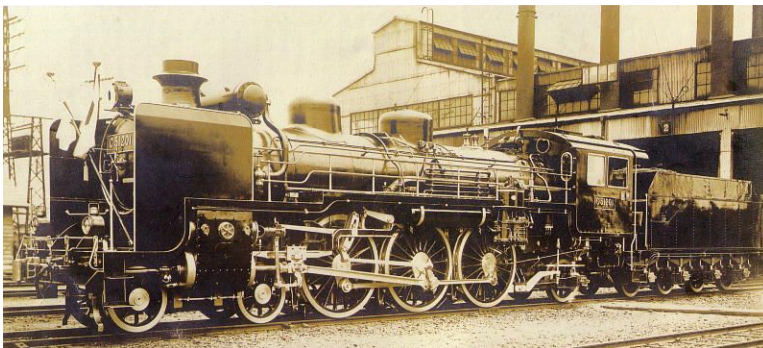
Introduction



- Japanese Shinkansen
 - Network of High Speed Railways across Japan
 - The Shinkansen has a 50-plus year history carrying over 10 billion passengers.
 - The network has 2,764.6 km of lines with maximum speeds of 240–320 km/h.
 - The original Tōkaidō Shinkansen, connecting Tokyo, Nagoya and Osaka, three of Japan's largest cities, is one of the world's busiest high-speed rail lines.
 - In the one-year period, it carries 159 million passengers!

Historical Background

- World War II
 - Connections between East and West Japan
 - Railroad infrastructure
- Services began 1964
 - Economic expansionism
 - Incentive to “modernize” Japan
 - Connected Tokyo to Osaka
- 1960s-1980s
 - Period of extreme economic growth
 - Shinkansen facilitated growth



Public Opinion

- Positive
 - Better Mobility
 - Modernizing
 - Economic Opportunity
- Negative
 - Decrease in Rural population
 - Displacement due to construction
 - Wealth concentrated in larger cities



Costs

- Construction
 - Very large initial investment
 - Split costs
 - Company
 - National Government
 - Local Government
- Maintenance
 - Local Rails
 - “Third-Sector” Companies
 - Shinkansen
 - Rail Companies



Construction

- Existing Infrastructure
 - Through dense cities
 - Limited Time and Space
- Geography
 - Mountains
 - Low water season
 - Unstable ground
- Bridge Construction
 - Steel: Lightweight, Long Spans
 - Cranes
 - Fast and cheap
 - Disruptive
 - Block Erection
 - Nondisruptive
 - Large construction space



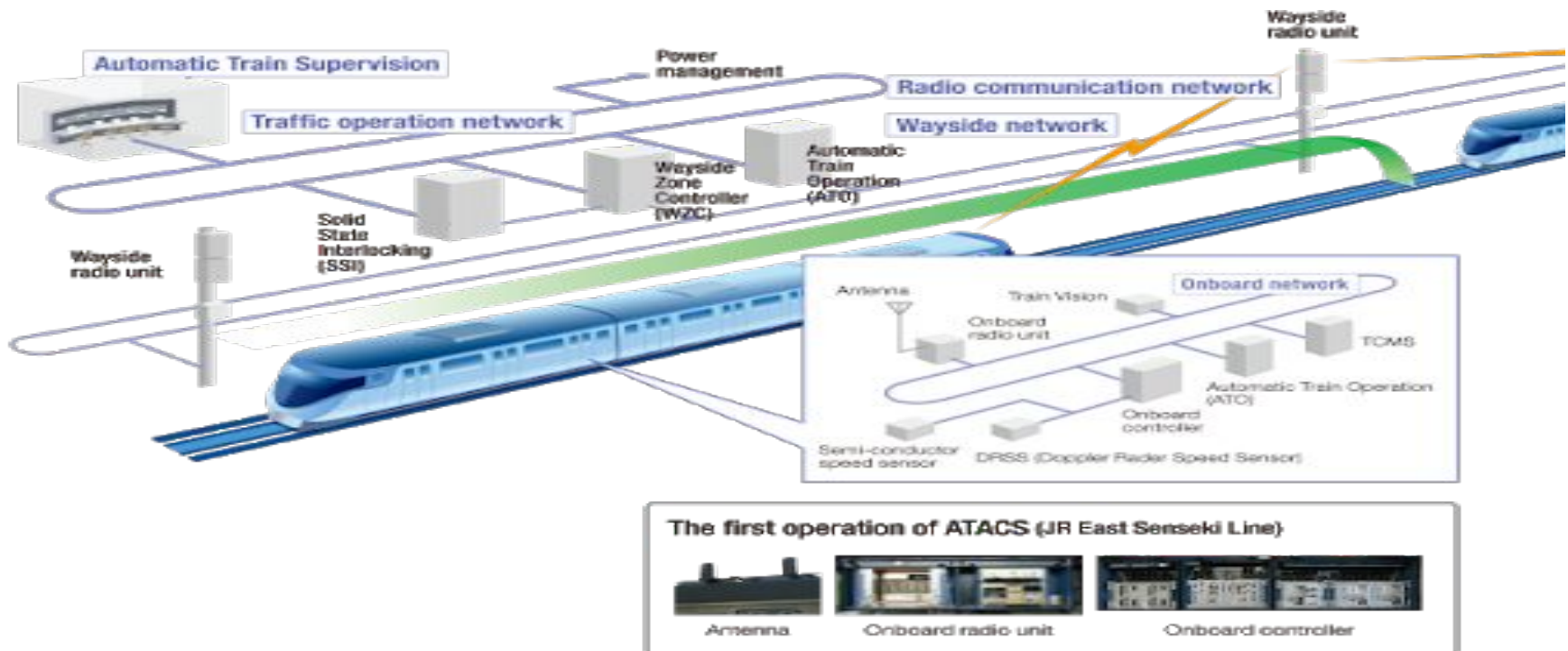
Construction

- Bridge Construction Cont.
 - Lateral Transfer
 - Nondisruptive
 - Small Construction Area
 - Assembly must be near operation site
 - Rotation Method
 - Non disruptive
 - Cheap
 - Time efficient
 - Small Construction Area
 - Jack Up Method
 - Built Top to Bottom
 - Each lower layer is jacked up



Operations

- ❑ The Shinkansen uses 1,435 mm in standard gauge
- ❑ The rails are also continuously welded with swingnose crossing points.
- ❑ The Shinkansen operation employs the Automatic Train Control System and Automatic Train Protection.



Materials

- 5083 Aluminium Alloy (Trains)
 - Prominent use in aerospace
 - Lightweight
 - Corrosion Resistance
 - Formable
- Reinforced/Prestressed Concrete (Tunnels)
 - Prevents track slab from moving
- Steel (Bridges)
 - Lightweight
 - Long Spans



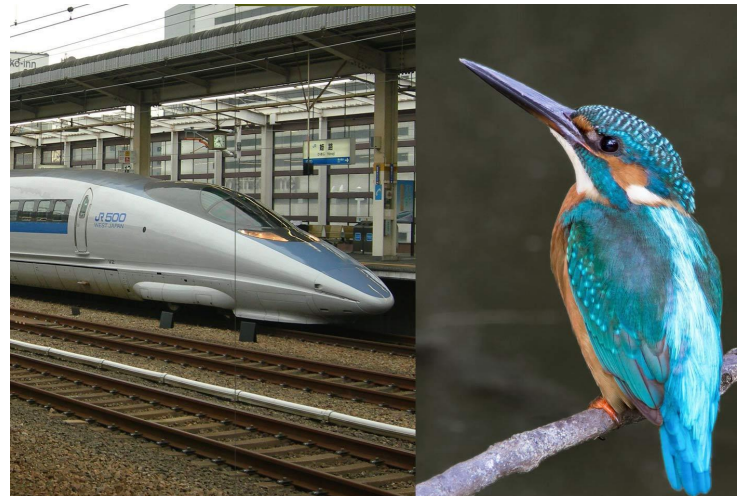
Aesthetics/Design

- Bullet Aesthetic
 - aerodynamic design
 - facilitates high speed
 - sleek exteriors
 - biomimicry (talked about further later on)



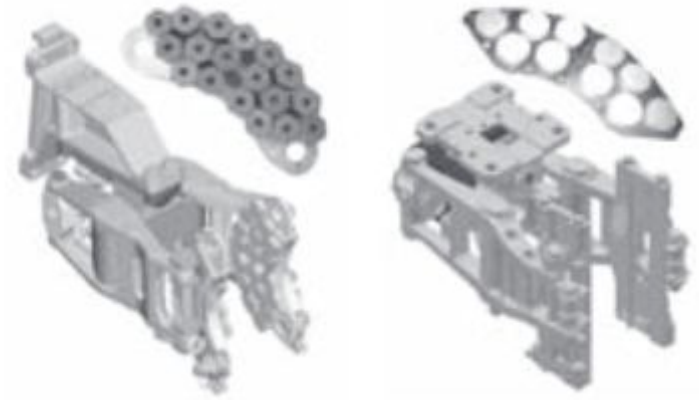
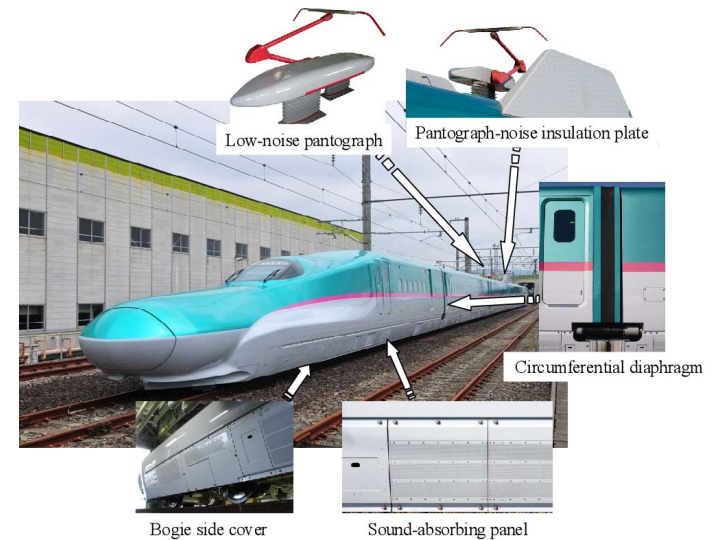
Important Engineers

- ❑ Eiji Nakatsu, an engineer and an avid bird watcher, is one of the most famous directors responsible for testing the Shinkansen during construction.
 - biomimicry
 - vortex generator
 - Mr. Seichi Yajima
- ❑ Owls and kingfishers



Problems and Safety

- Weather
 - Heavy Snowfall
 - Tsunamis and Earthquakes
- Safety
 - No Injuries
 - No Fatalities
 - High Performance Brakes
 - Training and Certification
- Noise Pollution
 - High population density
 - High Speed



Environmental Impacts

- ❑ Bullet trains greatly reduce air pollution and traffic.
 - example: airports
- ❑ The Shinkansen railways account for 7% of CO2 emissions in Japan.
- ❑ The Tokaido Shinkansen line between Tokyo and Osaka
 - consumes 1/8th the amount of energy per seat
 - discharges 1/12th CO2 emissions
- ❑ Noise pollution



That's a Wrap!

- ❑ The Shinkansen bullet train revolutionized the transportation system globally and brought back the widespread use of trains as public transit.
- ❑ During the construction of the bullet train system, it utilized new innovations such as different construction methods, and the development of modern train designs.
- ❑ Not only has the Shinkansen provided economic growth in Japan but it has cultural significance that identifies Japan's constant growing innovation in civil engineering and technology.



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