

The Chunnel Tunnel

Quick Facts

- \$21 billion – 80% over budget
- One of the Modern Wonders of the World
- Location: 31 miles long, under the “Manche Sea” between France and England
- A perfect circle of concrete to disperse all the stress through this shape
- Three tunnels – two for transportation, one for ventilation, repairs, and emergencies.
- The Chunnel operates 24/7, and transports 7 million passengers and 3.5 million vehicles/ year

Geology

- Four types of sediment found in layers: grey chalk, chalk marl, glauconitic marl, and gault clay
- Tunneled in the second layer – chalk marl, 80-100 ft: impermeable to ground water, soft to excavate, and strong enough to support itself without concrete walls
- Tunnel is 50 feet below gray chalk, decreasing the fractures, which would lead to swelling and the need for tunnel lining
- Overhanging chalk layers create a concern about the increased stress on the tunnel
- The French side has an anticline fold, creating displacements of about 150 feet.

Machinery

- Eleven Tunnel Boring Machines were used
- TBMs are roughly the size of two football fields
- French TBMs were closed initially due to high water pressures, which allowed the project to move forward without the need to grout ahead
- 250 ft of progress per day on average; took 3 years for the machines to meet in the middle
- English TBMs were driven deep into the seabed and buried; French TBMs finished the job and were dismantled

Challenges

- Ancient fault lines running along the Channel created earthquakes in 1580 and 1995
- Buried valleys filled with mud and sand were discovered while tunneling. Had they been hit during tunneling, it would have collapsed and flooded.
- The English terminal has displaced and tipping blocks of chalk, glauconitic marl, and gault debris. Stabilization methods included: buttresses, drainage channels, and toe-weighting.
- The French lined the entire section with neoprene and grout sealed bolted linings
- The English bolted their cast iron segments when they felt it was necessary
- Two plants to generate 15,000 tons of refrigeration

Impact

- Facilitate transportation and commerce between the UK and the rest of Europe
- 11 million cubic yards of soil
- Used to expand land and for a landscaped hill
- Two mile pipeline
- Required an inspection for noise and air pollution
- Used cut and cover method to minimize disturbance to area of geological, ecological, and archeological interest