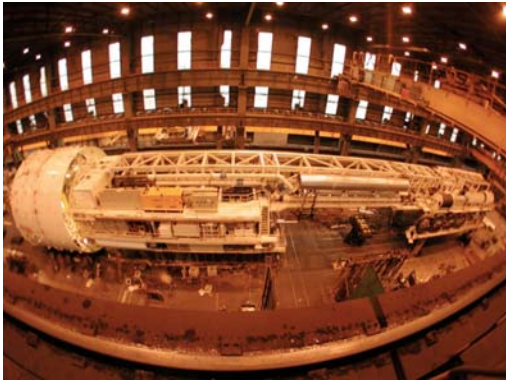


	Groene Hart Tunnel	Channel Tunnel	M-30 Ring Road
<u>Location</u>	Groene Hart wildlife conservation area, Netherlands	Links England (at Kent) and France (at Coquelles)	Madrid, Spain
<u>Tunnel stats</u>	<ul style="list-style-type: none"> Total length 5.3 miles Diameter 48 ft. Single tunnel with two rails 	<ul style="list-style-type: none"> Total length 31 miles (24 undersea) 3 tunnels (2 passenger rail, 1 service rail) 	<ul style="list-style-type: none"> Total construction will be 61.5 miles long (34.8 in tunnels) Project split into 15 sections that will use standard roads and/or tunnels
<u>Project description</u>	High speed (between 155-185 mph) double rail will provide link between Rotterdam and Amsterdam. Strict environmental requirements were set for project to minimize disruptions to area.	Second-longest tunnel in the world runs beneath the English Channel and connects England to Northern France. Mega-project involved 15,000 employees, 10 construction companies and 5 banks and took 7 years to complete.	Calle 30—Street 30—is heart of a major urban renewal project. Series of interconnected streets will run through tunnels and significantly improve access to urban areas.
<u>Cost</u>	Estimated at €380 million	Estimated at £10 billion	Estimated at €3.7 billion
<u>Tunneling method</u>	TBM used is 80 ft. long & 48 ft. in diameter. Single bored tunnel was excavated and TBM was also used to erect sections of concrete wall after boring.	11 TBM's—6 British, 5 French—were used to complete the tunnel. One of the machines was diverted into rock and left underground. (<i>Illus. 3</i>)	7 TBM's will be used in the project, which has been split into 4 directional regions. The project will use a mix of underground and cut-and-cover (shallow excavation which is roofed over) tunnels.
<u>Timeline</u>	Construction of TBM began in 2001 and completed in 2004. The Tunnel is expected to open in 2007.	Channel Tunnel has been operational since 1994. (<i>Illus. 4</i>)	Construction began in September, 2004 (<i>Illus. 5 & 6</i>) and estimated for completion in 2007
<u>Unique features</u>	“Aurora” (<i>Illus. 1</i>) the TBM used in the project, is the longest in the world and built to both excavate material and erect sections of the tunnel wall. (<i>Illus. 2</i>)	Despite its size, the Tunnel has had only one operational malfunction—a fire along the service rail that caused some structural damage.	Two largest TBM's in the world—“Dulcinea” and “Tizona”—measure 49.2 ft. and were built specifically for this mega-project.
<u>Additional information</u>	www.en.structurae.de/structures/data/index.cfm?ID=s0004213	www.eurotunnel.com	www.roadtraffic-technology.com/projects/m30_madrid/



Illus. 1—“Aurora”, the TBM used in the Groene Hart Tunnel was constructed in Le Creusot, France



Illus. 2—Sections of the concrete tunnel wall before construction—each section weighs nearly 14 tons



Illus. 3—One of 11 TBM's used in construction of the Channel Tunnel



Illus. 4—Waterloo railway station in Channel Tunnel



Illus. 5—The TBM launch chamber in Madrid



Illus. 6—Excavated material is transported through the rear of the TBM