THE MERSEY TUNNEL
LIVERPOOL-BIRKENHEAD
OPENED 1934

BRIAN ROBERTS
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VENTILATION FANS AND EQUIPMENT: System Diagram, Fan Impellers, Blowing Fan-1, Blowing Fan-2, Driving Unit, Pumps-1, Pumps-2, Switchgear, Emergency Control.

TUNNELS AND CONTROL STATIONS: Kingsway-1, Birkenhead, New Quay, North John Street, Sidney Street, Kingsway-2.

Brian Roberts, Budleigh Salterton, 2021
The driving of the pilot headings

Cast-iron lining used in preliminary tunnels where additional support was necessary
Construction of bottom half of cast-iron lining under river

Junction chamber in land tunnels
Facts and Figures in Brief

Length of roadway, Old Haymarket, Liverpool, to Chester Street, Birkenhead, through-traffic route—3,751 yards = 2.13 miles.
Length of roadway, New Quay, Liverpool, to Rendel Street, Birkenhead, dock-side traffic route—3,670 yards = 2.08 miles.
Total length of roadway, through and dockside routes, including open approaches—5,064 yards = 2.87 miles.
Total length of tunnels—2.62 miles.
Total area of roadway surface—487,300 square feet = 11 acres.
Ruling gradient is 1 in 30, with 1,670 feet of 1 in 300 gradient under middle of river.

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Width between kerbs in through traffic tunnel is 36 feet, for four lines of traffic.
Width between kerbs in dockside branch tunnels is 19 feet, for two lines of traffic.
Time required to pass through tunnel at 20 miles per hour is 6½ minutes.
Capacity of tunnel is 4,150 cars per hour with four lines of cars, spaced at 100 feet apart and moving at 20 miles per hour.
Distance from shaft at George’s Dock, Liverpool, to shaft at Morpeth Branch Dock, Birkenhead, is 1,735 yards = 0.99 mile.
Internal diameter of tunnel under river is 44 feet; external diameter is 46 feet 3 inches.

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Cross-sectional area of under-river tunnel is 1,680 square feet; more than double that of any previous subaqueous tunnel.
Total surface area of lining of tunnel is 1,773,000 square feet, or 41 acres.
The bottom of the under-river tunnel at its deepest point is 170 feet below high water.

The Mersey Tunnel

Average cover of rock over top of tunnel under river is 20 feet; minimum cover of rock under river is 3 ft. 6 inches.
Above the rock is usually 5 to 10 feet of gravel; above the gravel is clay, forming the immediate bed of the river at the place where the tunnel crosses.

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The average total cover of rock, gravel and clay above the top of the tunnel under the river is 30 to 35 feet.
Total excavation—800,000 cubic yards—1,200,000 tons.
The weight of explosives used was 560,000 lbs.
The total weight of cast-iron used to line the tunnel is 82,000 tons.
Total concrete in work is 150,000 cubic yards—270,000 tons.
Maximum rate at which water was pumped during construction was 4,300 gallons per minute.
The total amount of water pumped from the workings during tunnel excavation to October, 1932, was 7,482,000,000 gallons—33,400,000 tons.

For each ton of rock raised to the surface, 26 tons of water have had to be pumped to a height of some 200 feet.
The average rate of excavation during the period of tunnel driving was over one ton of rock every two minutes from June, 1926 to August, 1931.
The total number of bolts in cast-iron lining is one million.
The total length of caulked joints between segments of cast-iron lining is 140 miles.
The lengths of electric cabling for the tunnel are—lighting cables, 78 miles; power cables 4.5 miles; control cables (length of actual conductor) 300 miles; telephone and signal cables 201 miles—total 583.5 miles.
Maximum delivery of fresh air to the tunnel: 2,500,000 cubic feet per minute. Equal volume exhausted.
The total capacity of all ventilating fans: 10,000,000 cubic feet per minute.
The total number of men employed directly on the tunnel during the height of the construction period was 1,700.
MERSEY TUNNEL VENTILATION

The impeller of one of the Walker fans

The impeller of a Sturtevant fan

Blowing fan and casing at George's Dock ventilation station, Liverpool
MERSEY TUNNEL VENTILATION

Blowing fans at Sidney Street ventilation station, Birkenhead

The driving unit of the fans
MERSEY TUNNEL PUMPS

The mid-river pump room

The pump room at M COVERTH Dock, Birkenhead
MERSEY TUNNEL ELECTRICAL SERVICES

The switchgear room at Sidney Street ventilation station, Birkenhead

Control board for telephone, fire and emergency systems
MERSEY TUNNEL

The Ventilation Station at North John Street, Liverpool

Sidney Street, Birkenhead, Ventilation Station
REFERENCES AND FURTHER READING


CIBSE Heritage Group: www.hevac-heritage.org
/Organisations: Merseyside & North Wales Region, Chapter 10.