

# The Tyne Tunnels

Since the 1950s four tunnels have been constructed to cross the River Tyne, between East Howdon/North Shields and South Shields/Jarrow. The first two were pedestrian and cyclist tunnels serving mainly the shipyards' workforce on the river.

The first vehicle tunnel followed in the 1960s as the region's road network was developed. As traffic levels grew over 40 years, increasing congestion at the tunnel was common. To relieve the bottleneck and stimulate economic growth, a second road tunnel was built to complete the dual carriageway under the river.

## A Brief History of the Tyne Tunnels

The original Tyne Tunnels Project was conceived in the 1930s and planned as three tunnels linking Jarrow in County Durham (now South Tyneside) to East Howdon in Northumberland (now North Tyneside). The project was developed and steered by a Joint Committee of the two County Councils, who were the highway authorities at the time. A bridge option was quickly discounted due to the large ships heading for the Tyneside shipyards requiring considerable clearance above river level. This was prohibitively expensive.

Owing to financial constraints, the project was delayed but eventually delivered in two phases. First was the construction of the two parallel, but separate, pedestrian and cyclists tunnels, which were completed and opened on 24th July 1951 by the Minister for Transport. The second phase involved construction of the road tunnel, officially opened by HM The Queen on 28th October 1967. The A1 trunk road was routed through the tunnel until later diverted to the Newcastle Western Bypass.

Thereafter the tunnel linked the A19 trunk road.

The road tunnel was well used and congestion was common from quite early on its life. It was clear a second tunnel had the potential to relieve the bottlenecks and open up the region's economic prospects. The New Tyne Crossing project was conceived in the early 1990s and developed in earnest from 1998. It comprised a new 2-lane road tunnel to carry southbound traffic, with the original tunnel refurbished to current safety standards, for vehicles travelling north. The project required extensive highway works to connect the tunnels to the A19 trunk road. However, the project was completed ahead of schedule and fully opened on 21st November 2011. A major refurbishment of the pedestrian and cyclist tunnels is due to commence in autumn 2012.

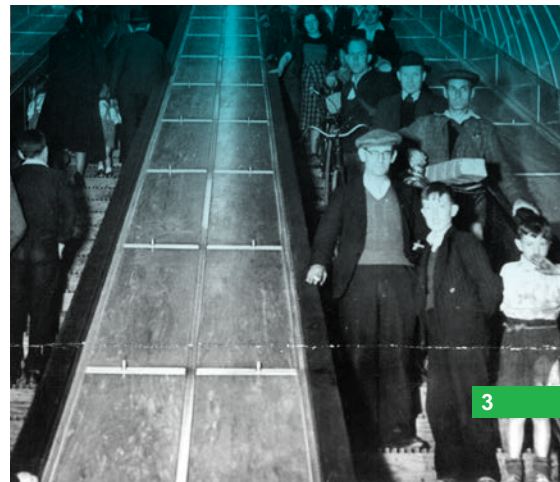
The North and South Shields ferry did originally carry road vehicles but is now restricted to pedestrians. The tunnels therefore represent the only river crossing for vehicles at the coast, the next being the numerous bridges between Newcastle and Gateshead. Whereas the pedestrian and cycle tunnels have always been free to use, vehicles are subject to a toll.

## Pedestrian and Cyclist Tunnels

The pedestrian and cycle tunnels are separate, parallel tunnels. They effectively served as pilots for the larger sized road tunnel, in terms of assessing the ground conditions beneath the river. Both tunnels are 900 feet (277m) and 10ft 6 inches (3.23m) and 12 feet (3.7m) in diameter.

They are accessed by vertical lift shafts and escalators housed in an inclined shaft 200feet (61.5m) long. The escalators are Otis Waygood machines and, when installed, were the longest single lift wooden escalators in the world.

The tunnels were constructed in compressed air to hold back ingress of water. This is a common technique whereby high pressure at the working face inhibits the inflow of water from surrounding ground, sufficient to enable the skin of cast iron segments to be fitted.





The tunnels cost £900,000, 75% of which was met by a grant from the Ministry of Transport with the remaining 25% raised by the County Councils of Northumberland and Durham.

The tunnels were opened in 1951, and heralded as a contribution to the Festival of Britain. When first opened they were used by 20,000 people a day to access their places of work. At the time, the river was home to many shipyards and related industries and the majority of the workforce walked or cycled from nearby housing. By 2010, usage had reduced to 20,000 people a month, which indicates how much work patterns had changed.

In 2001, the tunnels were given Grade II Listed Building status and, in July 2010, the current owners allocated £6m to refurbish them. Part of the planned work is to replace two escalators, which are beyond economic repair, with inclined lifts. Listed Building consent for the work was granted in October 2011 with work scheduled to commence in the autumn of 2012.

## Original Vehicle Tunnel

Completion of the road tunnel in October 1967 marked the realisation of a dream long cherished by Tynesiders. The tunnel is nearly a mile long at 5,500 feet (1,690m) and it has an internal diameter of 31 feet 3 inches (9.6m).

It was again constructed using compressed air, one of the longest to be built in compressed air in the UK. The crown of the tunnel is 50 feet (27.7m) below the river bed and 90 feet (15.4m) below high water level in the river. It had a carriageway width of 24 feet (7.3m) and minimum headroom of 16 feet (4.9m).

The carriageway was formed from a concrete slab within the diameter of the tunnel with various services placed in the void beneath it. It was designed to carry vehicles weighing up to 180 tons.

Emergency and service walkways were placed alongside, and a few feet above, the carriageway. An inner lining was added to give a lighter appearance and to protect electrical and mechanical services.





The tunnel was completed in 1967 after nearly six years of construction, but was not fully operational until 1968 when the approach roads were completed. Built to dual carriageway standard, they extended for three miles in total – north to the A1058 Newcastle to Tynemouth coast road and south to the A184 Gateshead to Sunderland trunk road. Associated works involved the construction of three railway bridges, three road bridges, a diversion and a viaduct for the Jarrow light railway. The river Don was also diverted.

Mott Macdonald was the consulting engineer for the design and construction supervision of all the three tunnels and subsequent various refurbishments and enhancement projects. These included installing jet fans in the vehicle tunnel; upgrading the vehicle toll system and an early refurbishment of the pedestrian tunnels. The main contractor for tunnel construction was Costain.

The vehicle tunnel, services, ventilation and toll collection equipment and administration buildings cost £8.5m. On-surface highway and other works cost £4m of which the Ministry of Transport granted £3m and the two County Councils each contributed £0.5m. The balance was borrowed by the County Councils with the intention that repayment would come from toll revenues, though this was not actually achieved.

The Ministry of Transport, responsible for the trunk road network, refused ownership of the Tyne Tunnel, despite the A1 routing through it shortly after opening. This was because they would have been burdened with the debt. It was a sore point politically, especially with disagreement on paying tolls to use a trunk road, though it is now not uncommon on major river crossings. Eventually, the tunnel passed to Tyne and Wear Metropolitan County Council who became the highway authority following local government reorganisation in 1974. When abolished in 1986 it passed to the separate authorities of North Tyneside, South Tyneside, Newcastle, Gateshead and Sunderland. They became joint owners, under the Tyne and Wear Integrated Transport Authority, in recognition of the strategic importance of the tunnel.

The original toll for cars was 2s 6d (12.5p) which persisted for many years, perhaps due to the political arguments mentioned. As a result the combined revenue was less than the cost of operating the tunnel and meeting the financial arrangements. Consequently, rather than paying off the loan, it gradually increased. The debt was never taken on by central government, and eventually tolls started to rise to more realistic levels. As of 2012, the toll charge for cars is £1.40, vans and HGVs £2.00. Buses (PSVs) and motorcycles still use the tunnel for free.

Tolls were initially paid by handing cash to tunnel staff in booths, and dispensed change if required. This was later changed to a



‘money-in-the-basket’ system at most booths, requiring the correct change to open the barrier. More recently, a permit system was introduced for frequent tunnel users. These are passive electronic discs on the inside of a vehicle's windscreen, which are read by the toll booth scanner to open the barrier. The permit holder's account is then debited.

By 2000, the tunnel was carrying 35,000 vehicles per day and operating at nearly 50% above its design capacity of 24,000. Congestion, at peak hours especially, was often severe, leading to lengthy journey times, to the detriment of the local economy and environment.

## Tunnel Safety

On the 24th March 1999, a Belgian transport truck, carrying flour and margarine, caught fire in the Mont Blanc tunnel, in the Alps. The effect was devastating, killing 39 people. An urgent safety review of major tunnels in Europe ensued, with the Tyne Tunnel officially rated as "poor" and described as one of the least safe in Europe. Its operational safety record however was recognised as very good.

Inspectors found no automatic fire alarm system, poor lighting, no laybys or hard shoulder, and an emergency walkway reachable only by able-bodied people. These deficiencies would likely have exacerbated a serious incident in the tunnel such as a vehicle fire. The smoke extraction system was also criticised for giving an uncomfortable ride through the tunnel. All of these issues would be addressed during the tunnel's refurbishment in 2011.

The original road tunnel was refurbished with the same safety features as the second tunnel. It is fitted with a fixed fire suppression system (the first of its type in the UK) which releases a fine mist to contain fires, helping motorists leave safely and preventing damage to the tunnel structure. There is now also a separate evacuation corridor, running adjacent to the main tunnel. The project has transformed the tunnels into some of the safest in the UK.





## New Tyne Crossing Project

To address capacity constraints at the Tyne Tunnel, the New Tyne Crossing project was initiated in 1998. It was delivered by a Public Private Partnership between the owners, Tyne and Wear Integrated Transport Authority and a private company created specifically for the project, TT2 Ltd. The project involved construction of a new 2-lane tunnel and major refurbishment of the 1967 tunnel, pedestrian and cycle tunnels. The project also passed on responsibility for management and maintenance for all tunnels over a 30 year period. It was valued at £260m in 2007 prices, with the intention of recouping the costs through toll revenues.

The project required statutory legislation, resulting in the Tyne Tunnels Act, 1998. A public inquiry was held in 2003. And while executive powers to build the new tunnel came into effect in 2005, there was a High Court challenge on environmental concerns regarding river dredging. This was eventually overruled and procurement for design and construction began in earnest. In November 2007, TT2 Ltd was appointed Concessionnaire and tunnel ownership and employees formally transferred to them on 1st February 2008. Construction of the second tunnel commenced shortly after.

The second Tyne Tunnel was designed and built by Bouygues Travaux Publics. It involved 360m of immersed tube, two lengths of sprayed concrete lined tunnel (31m and 40m), a cut and cover tunnel (1,100m) and a section of tunnel that passed over the old tunnel with a 3m clearance. Significantly, the difference from the first tunnel was that rather than tunnelling under the river, it was constructed in a dry dock as four tubes, each 90m long and weighing 10,000 tonnes, and towed into a trench on the river bottom. As the new tunnels are much shallower in depth, the gradient to the bottom is less severe than the original. The safety hazards of working in compressed air were also eliminated.

The new tunnel has an escape passage running the entire length (1,600m) with access points throughout, while the original was converted to a rectangular box within the circular cross-section, leaving room to





provide the same. Fixed fire suppression systems were installed in both tunnels, as mentioned previously.

Work on the surface involved major highway alterations to connect both ends of the tunnels, including a new grade separated junction on the south side in Jarrow to allow uninterrupted traffic flow into the tunnel. Toll plazas were reconstructed on the north side. Some 600,000 cubic metres of dredging and surplus excavated material were placed in Tyne Dock to aid the Port of Tyne's redevelopment.

The second tunnel was commissioned on 25th February 2011 and used initially for two-way traffic while the original was refurbished. Both fully opened on 21st November 2011, some two months ahead of the original programme. Their effect has been dramatic, with over 45,000 vehicles a day using the tunnels. Previous delays at peak times often stretched to 45 minutes, whereas now a 10 minute delay would be regarded as significant.

More information on the Tyne Tunnels can be found at [www.newtynecrossing.info](http://www.newtynecrossing.info).

*Thanks to Paul Fenwick at Newcastle City Council, Technical Services Division, for preparing this article.*

*Paul was seconded to the Tyne and Wear Integrated Transport Authority during the New Tyne Crossing Project.*

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