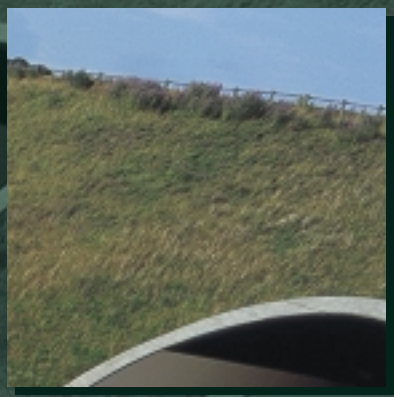
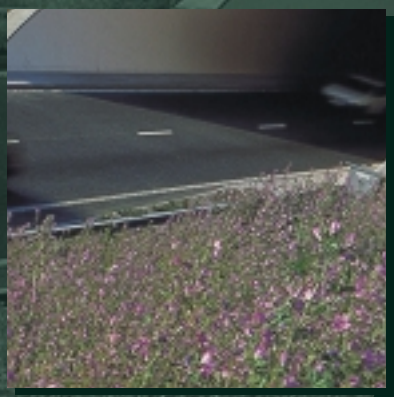
AA

Developing Britain's transport system to rival the best in Europe

Going Underground

TUNNELS: What role in town and country?





improving travel reliability, safety and th

Introduction

The government's aspiration is to make Britain's transport system the rival of any in Europe. For the first time for a quarter century, plans are being developed across Britain to tackle our transport problems. Planners and policy makers need to be aware how other countries are applying modern tunnelling methods.

No-one should contemplate a tunnel option lightly or think any environment can justify the cost. The cost of building tunnels can be high. Unexpected ground conditions can lead to runaway costs. Nevertheless, even if the topography or the geology isn't obviously favourable, tunnelling is an option that should be seriously considered for historic towns, for areas of truly outstanding natural beauty, for major urban areas, and for pressure points where a short length of tunnel can release benefits from a whole network.

There are geologies where tunnelling can be an attractive economic option. The extraordinary tunnel building programme in Norway of recent years bears witness to that. In towns and cities too, where property acquisition and the costs of moving utilities can be sky high, tunnelling can make real economic sense.

But it is usually the environment that changes the balance sheet. And a more prosperous Britain aspiring to match European standards should be willing to pay to protect precious urban space and countryside.

As tunnelling costs continue to fall, there are new options to "re-conquer" degraded surface streets in our towns and cities. Tunnels can take through roads away from people. Local roads can be freed up reducing the risk of emergency services being stuck in heavy traffic, improving the reliability of bus services, and making walking and cycling safer and less threatening. Tunnels can create real value, not just for travellers going underground but by allowing networks of streets to be reborn and increasing the liveability of whole urban areas.

Why more tunnels are being built:

Cost

- the cost of tunnel construction has been falling by around four per cent each year
- from around £50m per km, urban tunnels can be cheaper than surface building where acquiring land or moving utilities is expensive

Construction

- technologies for boring tunnels and building underground structures have made rapid advance thanks to the Channel Tunnel and other projects
- new technologies for blasting tunnels have transformed the economics of rural tunnelling where the right geology exists
- while vehicle emissions on surface streets flow straight into the air, harmful pollutants in tunnels can now be collected before ventilation and "scrubbed" near clean using new technologies
- new cross-sections have been developed which carry two levels of light vehicles in a single tube slashing the cost of tunnel provision

Safety

- the accident record of rural tunnels is twice as good as rural roads
- reductions in urban accidents can be achieved using tunnels as a key enabler for integrated transport and environmental improvement schemes
- safety commissions are satisfied tunnels can be provided with high standards of emergency equipment, monitoring and operation.
- separating heavy vehicles from light vehicles in tunnels not only has major cost advantages but also reduces the risk of major incidents

Environment

- demand for higher environmental standards is rising
- in rural areas, tunnels can deliver outstanding environmental benefits, albeit at high cost, in areas of outstanding natural beauty and even enable old roads to be returned to the countryside
- in urban areas, tunnels can remove through traffic and help enable whole networks of surface streets to be "re-conquered" and re-modelled with major benefits to emergency services, walking, cycling, local access, public transport services, and general liveability

Pricing

- motorists worldwide reluctantly accept that toll payment for major expensive improvements can be fair where an alternative route is available
- "fluid pricing", where tolls vary by time of day according to demand, is becoming more common both as a way to fund infrastructure and to ensure expensive new capacity is well used and congestion avoided
- some transport economists argue that pricing of major new metropolitan road infrastructure benefits the whole transport system
- where motorists have a choice of route, tolls can now be collected electronically avoiding delays and unsightly toll booths

A Tale of Two Cities

Boston, USA - the "Big Dig"

Downtown Boston before the "Big Dig"

Boston's problem is an elevated six-lane highway running through its city centre carrying 190,000 vehicles per day. Congestion, costing US$500 million a year, lasts eight hours a day. Accident rates are four times the average for an urban interstate highway.

Boston's "Big Dig" is the most ambitious tunnel project in the world. The US$12.2 billion project is running over budget and is not without its critics.

Project officials say a booming economy, unforeseen problems underground and the logistics of keeping a city running while 80 miles of traffic lanes are built underneath it, make it a unique challenge.

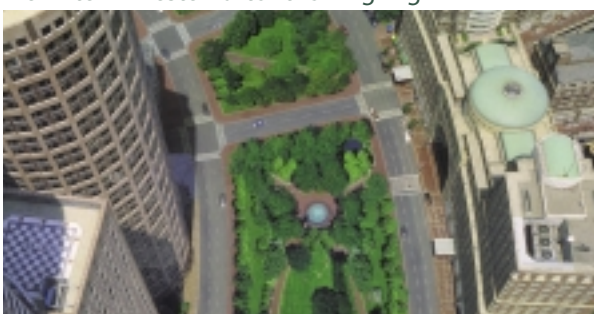
The project is however seen as vital for mobility, the environment and economic growth in Boston and New England.

As well as freeing up traffic, more than 150 acres of new parks and open space will be created. Twenty seven acres of this will be where the elevated structure now stands. Carbon monoxide is forecast to drop by 12% across the city.

The "Big Dig"

1982 Project planning begins
1987 Congress approve funding
1991 Construction begins
2004 Scheduled completion

Downtown Boston after the "Big Dig"

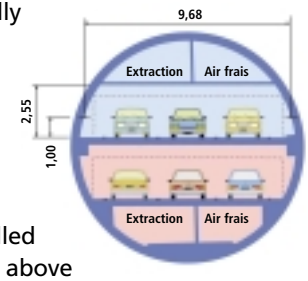


Paris, France - the Versailles Tunnel

A86 Paris Ring Road's "Missing Link"

While London's South Circular road remains a collection of signposts, the Versailles tunnel is the Gallic solution completing the final 10 km of Paris' 78 km A86 ring road through forest parkland, historic Versailles and residential areas.

Costs have been radically reduced by building the tunnel for light vehicles only. This means dual 3-lane carriageways can fit in a single bored tunnel and the road network can be re-modelled to re-conquer road space above ground.



The privately funded project will be financed by tolls, collected electronically, varying by time of day.

The Versailles Tunnel

1988 Light vehicle only tunnel proposed
1992 French Safety Commission gives approval
1995 Construction consent granted
2000 Construction begins
2004 Scheduled completion - first section

The flexible boring machine used can cut through terrain from wet, sandy soil to hard-packed, extremely resistant lime. Unlike Boston's "Big Dig", some 90% of construction is underground at a depth making surface noise and vibration imperceptible.

Lighting and other road features are carefully designed for safety and comfort to woo motorists from the alternative toll free routes available.

Tunnels - in town

Lyon, France

The East-West tunnel, a motorway 10 km long and accessible to all vehicle classes, opened to traffic in 1997. It was bored by latest technology equipment in difficult moraine soils. Operated as a toll tunnel, the income from motorists covers the ongoing operating costs and part of the tunnel investment costs.

Marseille, France

The "Prado-Carénage" toll tunnel opened to traffic in 1993 and is two km long. It accepts vehicles up to 3.2m in height.

Baden-Baden, Germany

Built in 1989, the Michaelstunnel was the only option for a spa town in a valley with a challenging topography. Maintaining good air quality was also a reason for taking the "by-pass" underground.

Brussels, Belgium

A familiar sight for Britons arriving in Brussels off the A10 autoroute from Calais. Dipping to the right hand side of the Basilique this well landscaped tunnel portal signals the start of a tunnel system taking traffic into and around Brussels' city centre.

Madrid, Spain

New road and underground railway tunnels are playing a key role in transforming Madrid's transport system and environment. Road tunnels are helping relieve the city centre, improving access to and from the motorway system and circumnavigating the capital on the M40 orbital motorway.

Sydney, Australia

Bridges and tunnels are needed to cross water but, not far from Sydney's famous landmarks, the new cross-city proposal will mean a better deal for pedestrians, cyclists and buses on the surface while cross-city travel times are cut by up to 20 minutes below ground. The twin two-lane road tunnels will be funded by tolls collected electronically.

The downside of tunnels:

- higher building cost and difficulties of cost control during construction
- "cut and cover" tunnels can be disruptive during construction
- good standards of daily operations required
- ongoing operational costs
- underground junctions difficult and potentially expensive
- siting of portals and ventilation shafts needs to be carefully selected

Tunnels - in country

Slowly, new tunnelling schemes are coming forward in the English countryside. Tunnelling is no longer reserved just for taking roads underneath rivers and estuaries.

Hindhead, Surrey

The A3 at Hindhead is the last single carriageway section of the A3 Trunk Road between London and Portsmouth. Proposals for improving this portion of the Trunk Road have been made over many years, but finding an acceptable solution has been difficult.

Balancing the needs of the road user with those of the local people and protection of the environment, a scheme has been added to the roads programme to build a 6.5km by-pass which includes 1.7km of twin bored tunnels under Hindhead Common.

The scheme will not only avoid direct impact on the Devil's Punch Bowl and Hindhead Common (a Site of Special Scientific Interest and Special Protection for birds) but would provide the opportunity to unite areas of National Trust land severed by the present A3. The economic benefits of the scheme are expected to repay the cost of construction twice over.

Operating for Safety

New tunnels must meet modern international safety standards. Recent surveys by the AA and sister European motoring organisations show, in comparison with Europe, existing UK safety equipment does not meet the best modern standards but operational standards are good.

Stonehenge, Wiltshire

A 2km tunnel at the Stonehenge World Heritage Site is included in a 9.2km scheme to complete a missing link on the A303 London to Cornwall trunk route and to bypass the traffic blighted village of Winterbourne Stoke. The scheme means the whole setting of Stonehenge can be uplifted with roads returned to the environment.

Southwick Hill, Sussex

Hardly noticeable from the surrounding area, the A27 burrows through Southwick Hill. The 490m tunnel, built in the 1990's, would not rate a mention in Europe but, in Britain, it is a rarity.

Twyford Down, Hampshire

The M3 link through Twyford Down was opened in 1994. This ugly gash in the Hampshire countryside will surely be the last time a surface road is built in preference to a tunnel if the environmental balance sheet is properly taken into account.

Developing Britain's transport system

to rival the best in Europe

- congestion on urban streets or busy inter-urban arteries costs time and money, threatens landscapes and living spaces, delays emergency services and leaves conflicts between people and vehicles
- advanced countries around the globe, in town and country, are increasingly willing to pay the cost of retaining landscapes or reclaiming surface streets by moving strategic roads or major arteries below ground at pinchpoints, sometimes over long lengths
- the accident rate in tunnels worldwide is half that of inter-urban roads and better than half in urban areas
- techniques of tunnel construction have made major advances in recent years – in some locations, tunnelling can even be cheaper than surface construction. Real costs are falling at around four per cent per annum.
- while vehicle emissions on surface streets flow straight into the air, harmful pollutants in tunnels can now be collected before ventilation and "scrubbed" near clean using new technologies
- light vehicle only tunnels (cars, taxis, vans) are emerging as highly economic solutions in studies and the 10km Versailles tunnel is already under construction using this method
- short lengths of tunnel can protect landscapes, as seen at Hindhead, or enable town centres to be liberated as commonly seen across Europe
- "fluid pricing", where tolls vary by time of day according to congestion, is becoming increasingly common worldwide as a means not only to fund new infrastructure, but to marry supply and demand for road space efficiently

Versailles – where tolls will vary by time of day according to congestion

Sydney – new cross-city toll tunnel will reduce journey times by up to 20 minutes for those for whom time is money

Hindhead – business, residents, motorists and environmentalists united in support for the tunnel solution

Baden Baden - liberating the town from through traffic

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