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Sixty Years of
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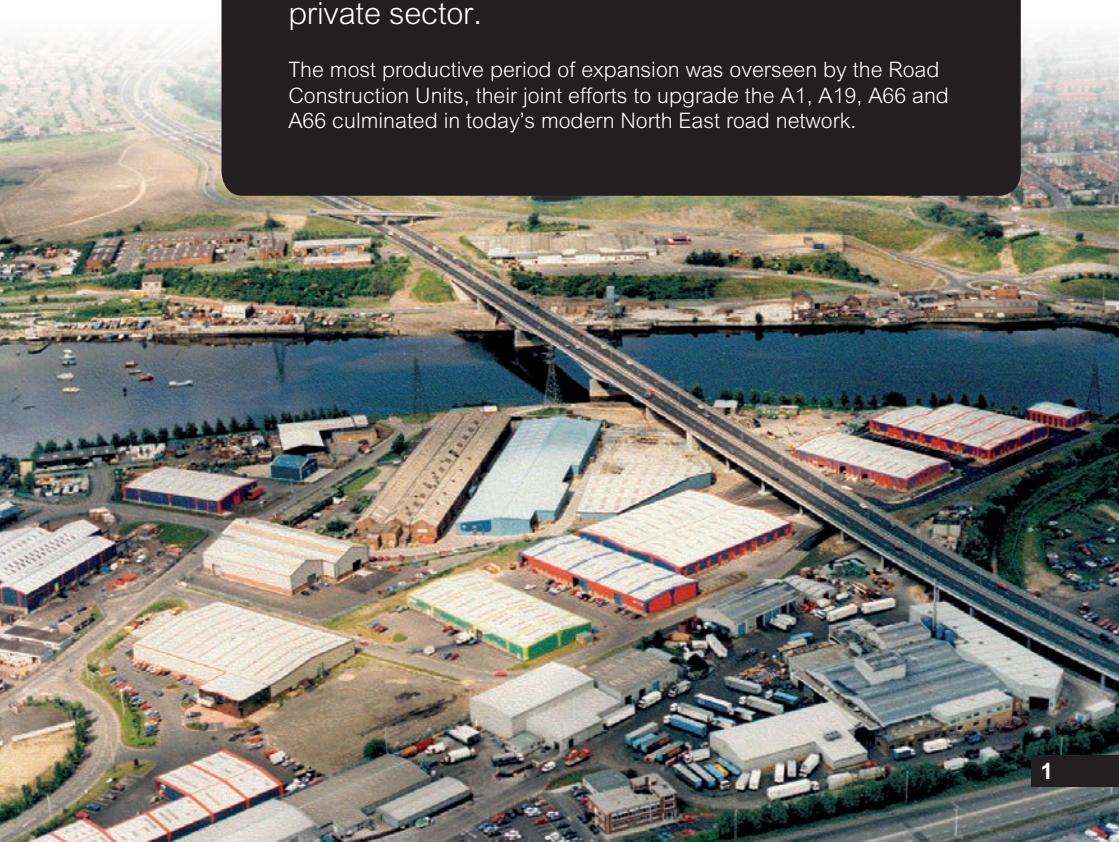
Motorway and Trunk Road Development in the North East

Central Government is responsible for the national motorway and trunk road network. Developing that network in the North East over the past 60 years has involved ever-changing partnerships between central and local government, and the private sector.

The most productive period of expansion was overseen by the Road Construction Units, their joint efforts to upgrade the A1, A19, A66 and A66 culminated in today's modern North East road network.



Background

Motorways and trunk roads in the UK are the only example of a complete infrastructure network funded solely by central government since the Roman Empire started building roads here in 43 A.D. Today, routes like the M1, M6 and A14 are managed by the Highways Agency, on behalf of the Department for Transport. This differs from the local road system where highway authorities take on those responsibilities.

In 1936, the Institution of Highway Engineers produced some of the first outline motorway proposals. The County Surveyors Society (CSS) followed suit in 1938, producing its own detailed map of 'suggested motorways', borne out of pre-war visits to Germany and the USA, where road networks were more developed. The CSS was made up of senior highways officers of local County Councils.

The principle of a new route for the A1 through County Durham was established in the early 1930s with the building of the Chester-le-Street and Birtley Bypasses, immediately before the Second World War. Interestingly, as early as 1943, also saw the first proposals for a Tyne Tunnel at an estimated cost of £2.5m.

However the full picture of a national road network did not appear until the Ministry of Transport outlined their proposals in 1946. Finally, the Special Roads Act, 1949 paved the way for constructing all future motorways in the UK but, due to an enormous maintenance backlog on local roads, combined with post-war austerity, the economics of motorways fell on stony ground.

Constructing the Modern North East Road Network

Some seven years after the Special Roads Act, 1949 came into force the commitment to build the first two motorway schemes was finally made in February 1955. The result, the Preston and Lancaster Bypasses, were opened in December 1958. A year later, a further 73 miles of motorway had been completed, including the first large sections of the M1. A substantial national programme of highway construction was finally under way. Subsequent proposals for motorway expansion into our region were prepared in 1963 by Durham County Council and Darlington Bypass became the first section of motorway to be completed in the county in May 1965. This was followed by the 22 mile long Durham Motorway, built in four sections and opened in September 1969. Throughout the 1970s and early 1980s saw major improvement to the A19 trunk road through Cleveland and Durham, including bypasses of Sunderland, Seaham/Seaton, Easington, Castle Eden, Wolviston and Billingham, eventually giving a continuous dual carriageway route to the Tyne Tunnel.

Northumberland County Council was equally busy developing schemes to upgrade the A1 through Northumberland to the Scottish border. From south to north, an 18 year period saw major improvements to the route, including Wide Open to Seaton Burn Diversion (1969), Seaton Burn to Stannington Bridge (1970), Stannington Bridge to Clifton (1987), Morpeth Bypass (1970), Felton Bypass (1981), Alnwick Bypass Stage 1 (1970) and Stage 2 (1985) and Berwick upon Tweed Bypass (1983), together with many smaller improvements. However, as the schemes were all built to different standards, it did not result in a continuous dual carriageway throughout the county.

At the same time, the A1 trunk road ran through the centre of Newcastle and Gateshead. A series of urban motorway links to the strategic network were planned by Newcastle City Council, but only partially completed – the main section being the Central Motorway East, opened in 1975, and designated at the time as the A6157(M) Great North Road.

The only other significant element completed was the Gateshead Viaduct. Whilst improving conditions for local traffic, fierce opposition and, finally, funding constraints, put paid to the rest of the plans. The A1 trunk road was eventually re-routed onto the Gateshead and Newcastle western bypasses, in 1991.

During this period, County Councils in England carried out the majority of design work as well as supervision of construction as agent authorities. Consultants were also employed, particularly on cross-boundary schemes and where major bridgeworks were involved. The need to deliver an extensive road building programme and meet the design standards of the 1960s and 1970s led to many innovations, including the first use of bespoke computer software and digital mapping, both of which are now highly sophisticated and common place.

While central government remained responsible for the overall strategy of motorway development, there was a close association between the Ministry of Transport and members of the County Surveyors, as both shared the majority of professional expertise at the time.

The Rise and Fall of the Road Construction Units

In 1967, to make best use of available expertise, the Government formed a number of Road Construction Units (RCUs), tasked with the design and construction of motorways and trunk roads in England. Each RCU had a number of Sub-Units staffed largely by employees seconded from the highway departments of county councils, and some employees of the Ministry of Transport, who retained responsibility for policy direction, standards and kept hold of the purse strings.

The North East RCU was based in Harrogate, North Yorkshire, with two Sub-Units at Durham and Wakefield, which, between them, undertook most of the highway design and supervision of construction. Sub-contracted consulting engineers were also regularly employed to provide specialist support. This arrangement reached its peak in 1972 when the RCU completed 237 miles of motorway and trunk road.

The Durham Sub-Unit delivered many significant schemes, including the A1(M) Birtley Bypass and A194(M) White Mare Pool to Black Fell improvement, both of which were completed in April 1970. Other major schemes within the North East RCU were the A69 Heddon/Horsely and Hexham Bypasses, A1(M) 'Durham motorway' and the A19 Billingham and A66 Stockton/Thornaby Diversions in Teesside. In North Yorkshire saw the A19 Thirsk and A64 York Bypasses, together with the Balkholme-Caves section of the M62 in Humberside, which incorporated the first lengths of continuously reinforced concrete pavement in the UK.

The RCUs were active for around 14 years. There were periods of intense work and also quieter periods with reduced programmes, especially post 1977 following a spending review on motorways and trunk roads. In 1978, the Department of Transport began discussions to review organisational arrangements and a possible reversion to agency arrangements. As well as a significant reduction in the road construction programme, local authorities were also required to further reduce spend on highway maintenance.

In 1981, Government unexpectedly announced that, with a reduced workload, the large RCUs were no longer appropriate. The Sub-Units were transferred to the private sector, along with their remaining programmes and the majority of staff. Bullen and Partners took on the responsibility of the Durham Sub-Unit and continued to deliver the remaining schemes in the North East. While controversial at the time, the changes opened up a new era for private sector consultancies which remains prevalent to this day.

Fluctuating Workloads and Administrative Changes

The largest project inherited by Bullens from the Durham Sub-Unit was the A1 Newcastle Western Bypass, opened in December 1990, at a cost of £88m. At the time, the Minister for Transport confirmed the Government's commitment to create a continuous motorway on the line of the A1, between London and Newcastle. Today, this is now achievable using the M1 and A1(M), barring one short remaining section between Leeming Bar and Barton in North Yorkshire.

Expenditure on roads increased again in the early 1990s, but as the decade progressed, many motorway and trunk road schemes were deferred or cancelled due to environmental objections and financial pressures. However, 'Design, Build, Finance and Operate' (DBFO) schemes were awarded to private contractors to maintain and enhance routes over a 30 year period. This allowed schemes such as A69 Haltwhistle Bypass and the A19 Norton to Parkway Improvement to go ahead, the monies being paid back to the DBFO contractor by the DfT through a 'shadow toll' arrangement.

Another milestone in the UK's motorway and trunk road history came in April 1994 with the creation of the Highways Agency – a distinct executive organisation within the Department for Transport (DfT). Its objective was to improve transparency, accountability and take over management of the road programme, which following a wholesale review, saw some schemes cancelled or transferred to regional programmes. For retained schemes, the Agency was responsible for administering contracts for design, construction and maintenance, along with establishing consistent standards across the whole spectrum of highway development.

In 1998, the Highways Agency's role was reviewed and expanded to that of 'network operator'. An emphasis was placed on managing a route through maintenance of infrastructure and implementing traffic management and network control to reduce congestion, increase journey time reliability and make the best use of existing assets. In a sense, a return to the philosophy of 1949!

Nevertheless, during the late 1980s, improvements to the A1 had continued in Yorkshire and eventually, in the 1990s, the Department of Transport turned its attention to upgrading the route to motorway standard, as had been recommended in earlier feasibility studies. This commenced in the mid 1990s and only completed in the spring of 2012, with the opening of the Dishforth to Leeming Bar upgrade. However, this left a short section unfinished – Leeming Bar to Barton, as mentioned previously. It is hoped this will eventually be completed in the not too distant future – despite it being just outside the area, it is a vitally important connection to the North East economy.

The management and funding arrangements for trunk roads were restructured again in 2001, when some 30% of the network not considered as core routes were subsequently de-trunked, as outlined in the Government paper 'The New Deal for Trunk Roads in England', published in 1998. Many of the roads to be de-trunked were brought up to relatively good standard by the Highways Agency, prior to the responsibility for management, maintenance and any further improvements being passed to the relevant local highway authority. In the North East, those trunk roads transferred included the A167 in County Durham, and the A696/A68 north from Newcastle Airport to the Scottish border, in Northumberland.

Maintenance Arrangements

Prior to 1986, motorways and trunk roads were maintained largely using agency arrangements with the County Councils, who used their resources to co-ordinate operations on the whole of the highway network in their area. Since then, maintenance has been contracted out to the private sector, overseen in England by the Highways Agency.

The national network was split into a number of areas, each with an Area Team (known as the Managing Agent) and Managing Agent Contractor (MAC), who were employed as consultants and contractors, where required. These were soon replaced by Asset Management Contracts and, for a short while, a consortium comprising Northumberland County Council, Newcastle City, North Tyneside and Gateshead won the initial contract to manage trunk roads in Northumberland. Today, we have Area 14, covering the whole North East region – some 305 miles of motorway and trunk roads along with over 420 structures. At present, Area 14 is managed by Aone+ Integrated Highway Services, a consortium of Halcrow, Colas and Costain.

Exceptions to this are those routes under a DBFO private arrangement over a 30 year period, which in the North East are the A168/A19 Dishforth to Tyne Tunnel and the A69 Newcastle to Carlisle, both of which are part of the Trans European Network.

A recent addition to the regional road network was the completion of the Second Tyne Crossing. Opened by Her Majesty the Queen on the 18 July 2012, it relieved a bottleneck along the A19 route, although it is not technically part of the trunk road – the Tunnel being owned by the Tyne and Wear Integrated Transport Authority, a consortium of local authorities. The second tunnel was delivered by a Public Private Partnership between the owners and TT2 Ltd, a private company created specifically for the project, and who also have responsibility for management and maintenance of the Tyne Tunnels for 30 years.

Celebrating our Successes

It has taken the full 60 year history of the North Eastern Branch to bring the region's motorway and trunk roads to their present stage of development. Many upheavals occurred in local government, county boundaries and administrative arrangements but infrastructure development continued to progress, despite the changes. How the highway network develops in the future remains to be seen – private sector funding and road user charging remain on the agenda and are constant subjects for debate.

In the meantime, credit must be given to the dedicated and professional staff of county surveyors and highways departments, consulting engineers and contractors for the significant achievements made over the past 60 years in planning, designing and building the region's motorways and trunk roads that we all use today.

Thanks to Roger Elphick OBE of the CIHT North Eastern Branch, for preparing this article. Roger is the former Director of Environment at Durham County Council.

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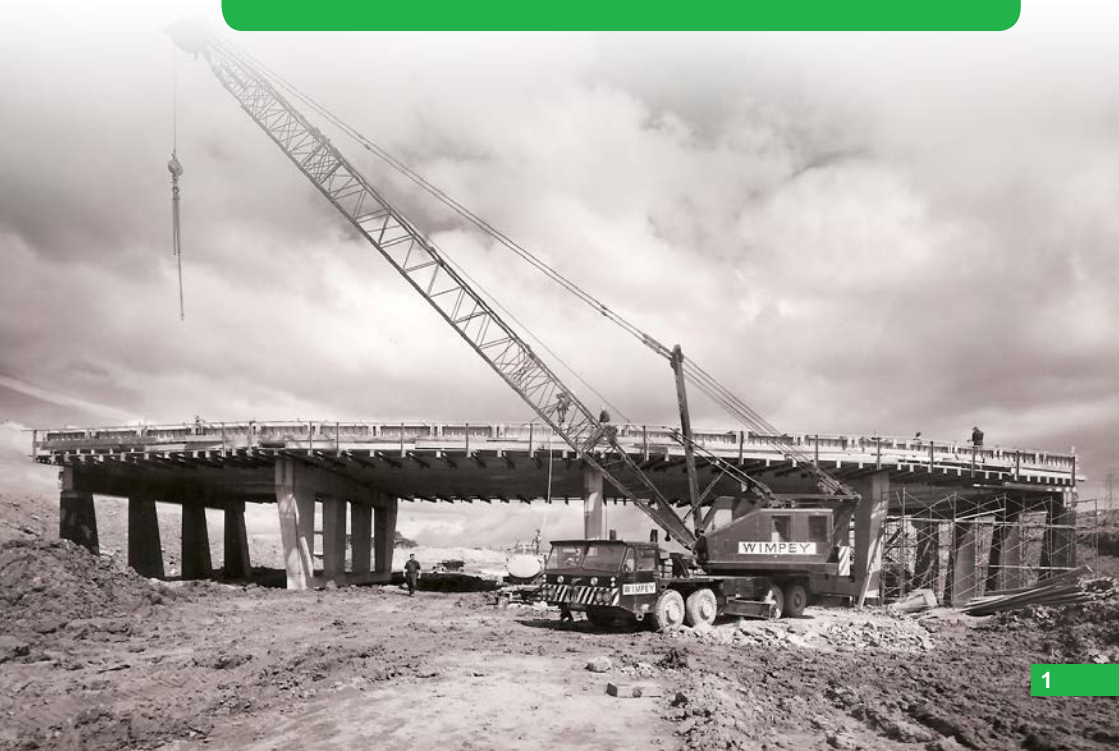
A189 South East Northumberland Spine Road

The A189 South East Northumberland Spine Road is a good example of a road constructed to promote the regeneration of a whole area through greatly improved road access. Construction started in the late 1960s and early 1970s, although upgrading of the northern end was carried out in the 1990s.



Building the Spine Road

North of urban Tyne and Wear, the A189 is often referred to as simply the Spine Road. It is a good example of a road which was constructed to promote regeneration of a whole area by greatly improving road access to Tyneside and the A1 and A19 trunk roads.

Construction of the Spine Road was undertaken in stages in the late 1960s and 1970s to facilitate regeneration of the historic coalfield area of South East Northumberland, which by this time was suffering from pit closures and loss of employment. The emphasis was on attracting new employment to the area and the Spine Road was an essential part of the regeneration by providing improved road access to the towns of Ashington, Blyth, including its port, and Newbiggin, as well as serving the then growing new town at Cramlington and other smaller communities in the area.

It was constructed on a "green field" alignment to mainly dual carriageway standards and with grade separated junctions. However at the northern end it was initially built to single carriageway standard which included the bridge across the River Wansbeck.

The A189 now carries in excess of 30,000 vehicles per day – more than the A1 north of Morpeth – and is one of the most heavily trafficked roads in the County. Since the early 1990s, Northumberland County Council has undertaken a £12 million four year programme to upgrade the northern end of the Spine Road, so that now the whole length between Woodhorn Roundabout and the A19 trunk road is now to dual carriageway standard.

The final part of this upgrading programme was completed in March 1998 with the provision of a second carriageway from the Sleekburn junction to north of the River Wansbeck. These works included a second bridge over the River Wansbeck at North Seaton alongside the one constructed in the 1970s.

The scheme included a cycleway/footway as part of a strategy to create an inter-urban cycle network in the south east of Northumberland. The scheme was carried out by a partnership approach between the County Council and contractors Balfour Beatty.

Thanks to Malcolm Smith, CIHT North Eastern Branch, for preparing this article.

If you enjoyed this article, try also:

'The Newcastle Central Motorway East and Other Plans'

'The Tyne Tunnels'

'The A1 Trunk Road'

'The A19 Trunk Road'

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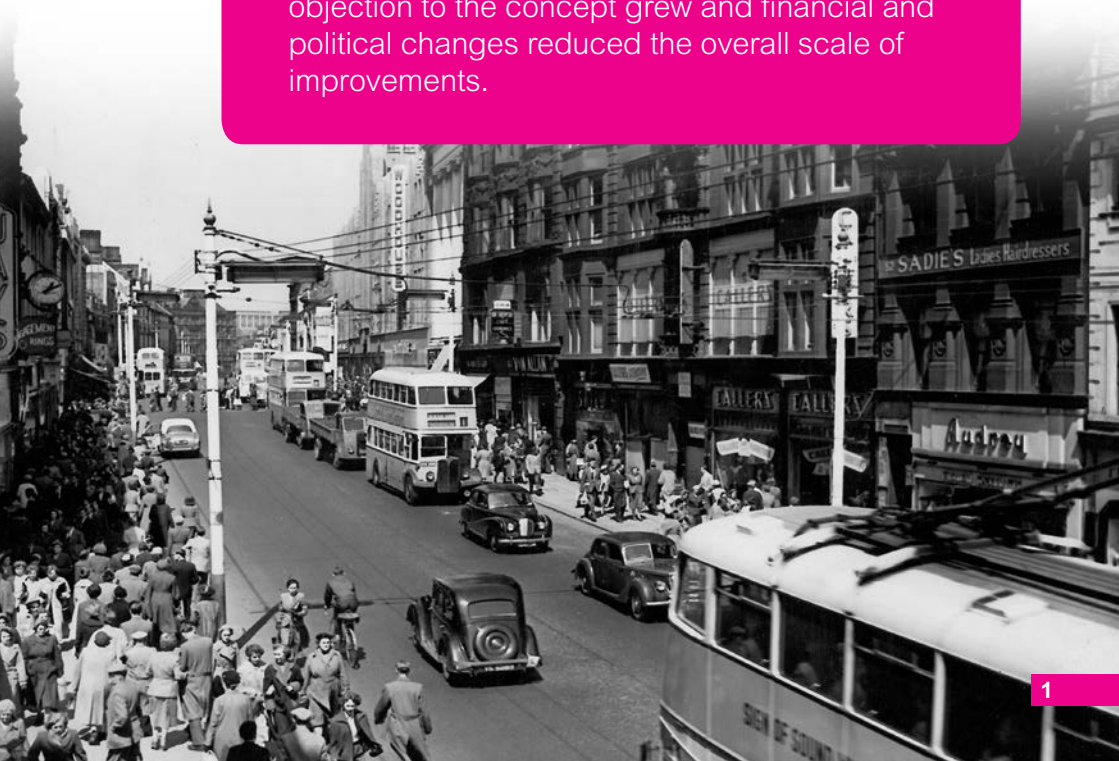
The Newcastle Central Motorway East and Other Plans

In the 1960s it was apparent the centre of Newcastle would not cope with future traffic. Major changes were planned via a motorway system. Some of the schemes saw fruition such as the Newcastle Central Motorway East (The CME) with immediate and long lasting benefits. However, as the plans were developed, objection to the concept grew and financial and political changes reduced the overall scale of improvements.



The Background to Change

Northumberland Street in Newcastle is now a pleasant pedestrianised street. However, many people will remember when it was part of the A1 Great North Road, linking the Tyne Bridge to Gosforth and onto Northumberland and Scotland, as well as being the principal shopping street in Newcastle.

At Christmas, to cope with the numbers of shoppers, heavy baulks of timber were placed to narrow the carriageway and widen the footways on Northumberland Street.

Temporary fencing was placed to prevent encroachment from the footways onto the carriageway because the situation was still fraught with danger due to over-crowding.

The Central Motorway East, more commonly referred to as 'The CME', was the result of the need for change.

The road was planned in the early 1960s, when road traffic and vehicle ownership in Great Britain were both increasing at about 8% per annum. It was predicted that 1980 traffic levels would be 5.3 times those in 1960 when taking into account the expectation that the relatively low vehicle ownership in the North East would catch up with the rest of the country, and also the anticipated effects of the city centre redevelopment.

The Central Motorway East however was only one part of a network of motorways that was planned at this time to cope with the increasing traffic situation. Newcastle and Gateshead had the A1 Trunk Road running through their shopping centres. At that time, the bridges across the River Tyne were the first vehicle crossings of the river, aside from the ferry between North Shields and South Shields. Local traffic wishing to cross the city from east to west, and vice versa, had to use roads along the quayside and through commercial streets within the city centre.

There is little doubt that the road network of Newcastle would have seized up if nothing had been done. Nevertheless there was much opposition to the plans. The organisation SOC'EM! (Save Our City from Environmental Mess!) was active in opposition and produced booklets through the early 1970s describing and arguing against the proposals. They were supported by the national organisation Transport 2000, formed in 1972 from representatives of railway unions and environmental groups who were against the decline of railways and the growth in motor vehicle use.

There was the expectation that Newcastle would be strangled by these motorways, a sentiment expressed in Lindisfarne's song 'All Fall Down'. There was also a national concern growing that the march of new roads across the country in the 1960s and 1970s was destroying both rural and urban areas and introducing noise and air pollution. Not least, urban motorways with viaducts had a visual intrusion unacceptable to many and they also produced severance between communities on opposite sides of the motorway. People in Newcastle increasingly reflected that concern and were becoming much more active in public inquiries that were an essential part of the legal process.

The motorway construction within Newcastle nevertheless commenced in 1972 but the city was perhaps saved by the oil price surge in 1974 that stopped many road schemes as the cost of road materials and incidental items soared. Also, as part of the reorganisation of local government in 1974, the City of Newcastle lost its role as the highway authority to the new authority Tyne and Wear Metropolitan County Council. That authority was to pursue the development of the Metro system, which took priority for finance over road schemes for many years hence.

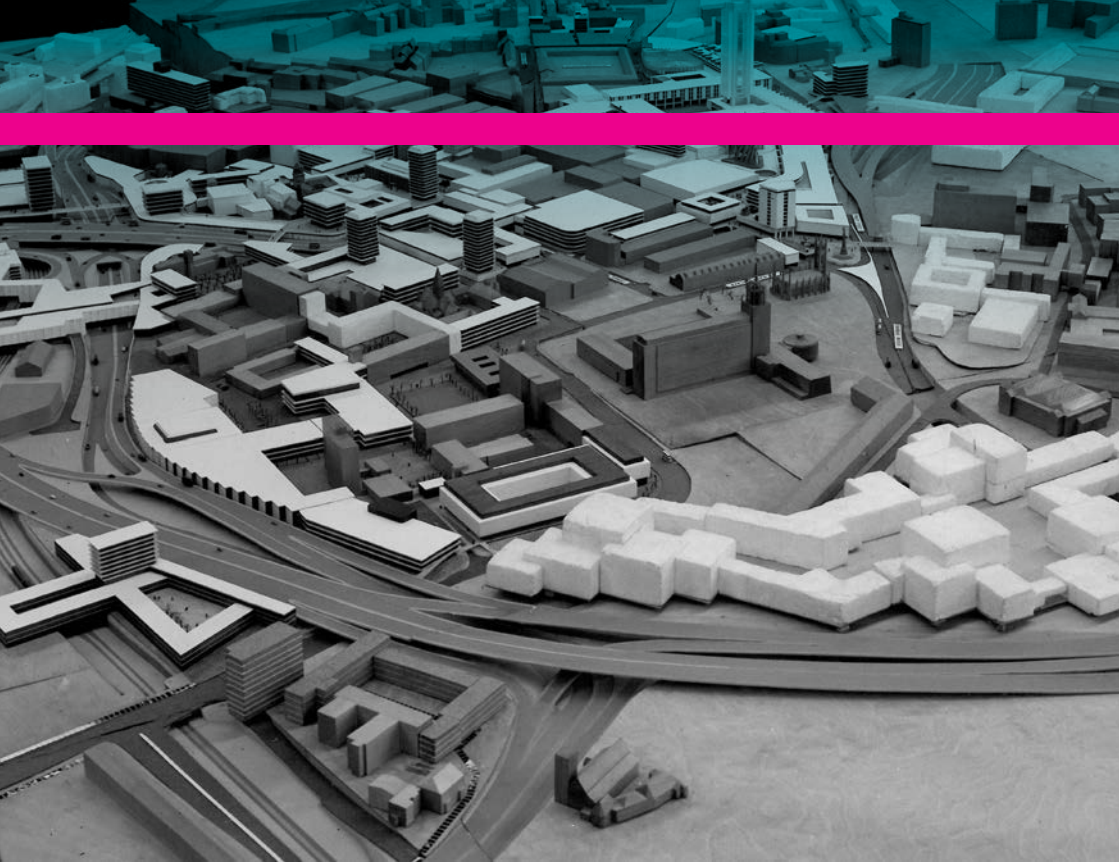
For those reasons the plans were implemented in part only, as described below.

The Motorway Plans

A number of connecting road schemes was planned within Newcastle and neighbouring areas.

The Central Motorway East (CME) was completed. It runs east of the city centre from The Great North Road coming from Gosforth to the Tyne Bridge. It has grade separated junctions with Jesmond Road, New Bridge Street and Pilgrim Street. This road carries the bulk of north-south traffic crossing the river.

The CME can be seen in the photograph of the model created to illustrate some of the proposed system. The start of the CME Bypass can be seen at the bottom of the photograph and also the East-West Underground Motorway as it would disappear under the central shopping area of Newcastle.



The Central Motorway East Bypass was never built, in any form. It would have run from spurs which were actually constructed on the Central Motorway East and the Gateshead Viaduct to accommodate the future links. It would have essentially provided a new bridge across the River Tyne to motorway standard.

It would undoubtedly have relieved the congestion that has occurred, and continues to occur daily, over the Tyne Bridge. It would also undoubtedly have been at considerable financial cost. There would perhaps have been less in terms of environmental damage as much of the route was to be redeveloped later. For example, the Northumbria University has utilised land north of New Bridge Street following a short lived cinema complex.

The East-West Underground Motorway was never built, in any form. It would have run beneath the shopping centre from New Bridge Street junction on the CME to the Gallowgate junction on the Central Motorway West.

The Central Motorway West (CMW) was not built. It was planned to run from The Great North Road near the Hancock Museum through Barras Bridge and the top of Percy Street before swinging across Gallowgate past St James' Park and on to the Redheugh Bridge, which at that time was to be a dual carriageway bridge. In due course, this route was downgraded in scale to a normal urban road with at-grade junctions. Part of this route was eventually developed as the West Central Route which was fully complete in 2001 and includes the St James Boulevard.

The Gateshead Viaduct was completed. It is a relatively short length of elevated road east of Gateshead town centre from south of the Tyne Bridge.

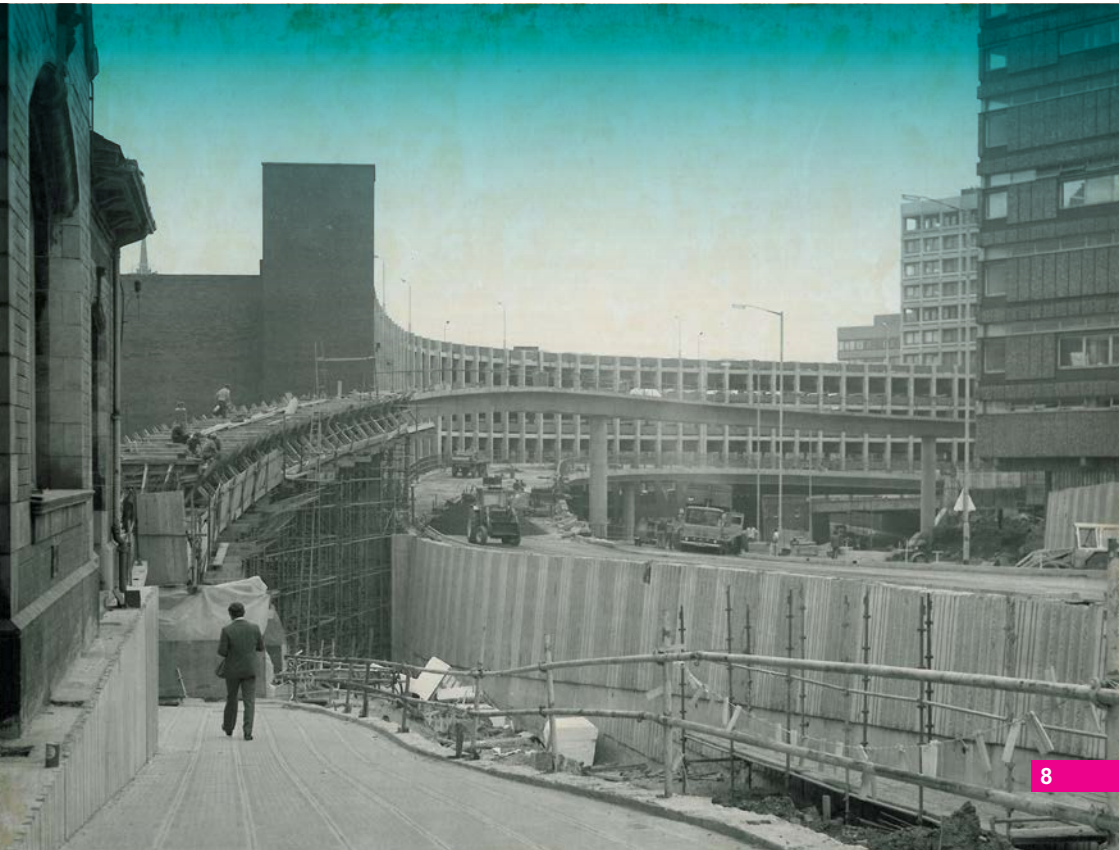
The Viaduct was part of the intended alternative route of the A1, bypassing the centre of both Gateshead and Newcastle. As on the north side of the river, the stub ends can be seen of what would have been the new motorway over the river. It was completed around 1969/70 and was the first part of that bypass route to be opened to traffic.

In 1965 Ove Arup & Partners won the competition to design the Gateshead Viaduct, under the direction of the Partner, Povl Ahm. On the basis of that he started the company's new transport group, specialising in bridges and serving as Chairman from 1989 to 1992.

The Claremont Road Motorway was in due course built as a dual carriageway running from the CME/Great North Road to Cowgate roundabout. Its construction started almost immediately after completion of the CME.

The North West Radial Route, as it became known, was designed and constructed by Newcastle City Council's City Engineers Department but was supervised by Tyne & Wear Metropolitan County Council's Director of Engineering. T&WMCC became the highway authority in 1974 following reorganisation of local government. The project cost approximately £4m and was opened to traffic in 1976. Surplus material from the project was taken to the Town Moor to form, the 'ski slopes'.

The route of the road was within the Town Moor. This was only possible when alternative areas of that part of Newcastle were given the same protective status as that enjoyed by the Moor, for example allotments and playing fields adjacent to The Great North Road.



Claremont Road was relieved of much traffic and now serves more local journeys and premises such as Newcastle University and the Royal Victoria hospital complex.

The Coast Road Motorway was built in part but a significant section in Newcastle was not. Tynemouth Borough Council built the eastern section in 1969 and the Wallsend section followed, built by Northumberland County Council, which was the highway authority at that time. Newcastle City continued it from there but it stopped at a traffic signal junction at Heaton Road. It was intended to continue through Cradlewell and along Jesmond Road to link to the Central Motorway East, which would have had a major impact on that locality.

In fact a public inquiry was held in September 1968 dealing with purchase of land. However, while construction was due to start in 1972, a Special Road Scheme for the route had not been published and objectors gained a 'stay of execution'. An inquiry was ordered which took place in May 1973. The scheme never got off the ground – the oil crisis of 1974 and the change of authority to T&WMCC stopping it in its tracks. It has been replaced in part by local improvements at Osborne Road and the Cradlewell Bypass.

The Shields Road Motorway was never built. It would have run along the line of New Bridge Street from the CME and ultimately bypassed Byker. The Byker Bypass was built as 4-lane road alongside the Metro.

There will always be debate about what was right, and what damage was done or might have been done by all of the proposed motorways. SOC'EM! predicted the cost of the motorways would have been £45m at 1972 prices. However, it is difficult to imagine the road network without the improved roads and motorways that were built, not least the CME.

Building the CME

New motorways were subject to specific legal process as 'Special Roads'. The Secretary of State for the Environment, at that time, could order a public inquiry before confirming the Scheme and the Order which gave authority to construct the road. A public inquiry into the CME was held in 1967 and the Minister for Transport pronounced in favour of the scheme in September 1968. The Scheme and Orders were confirmed in 1969.

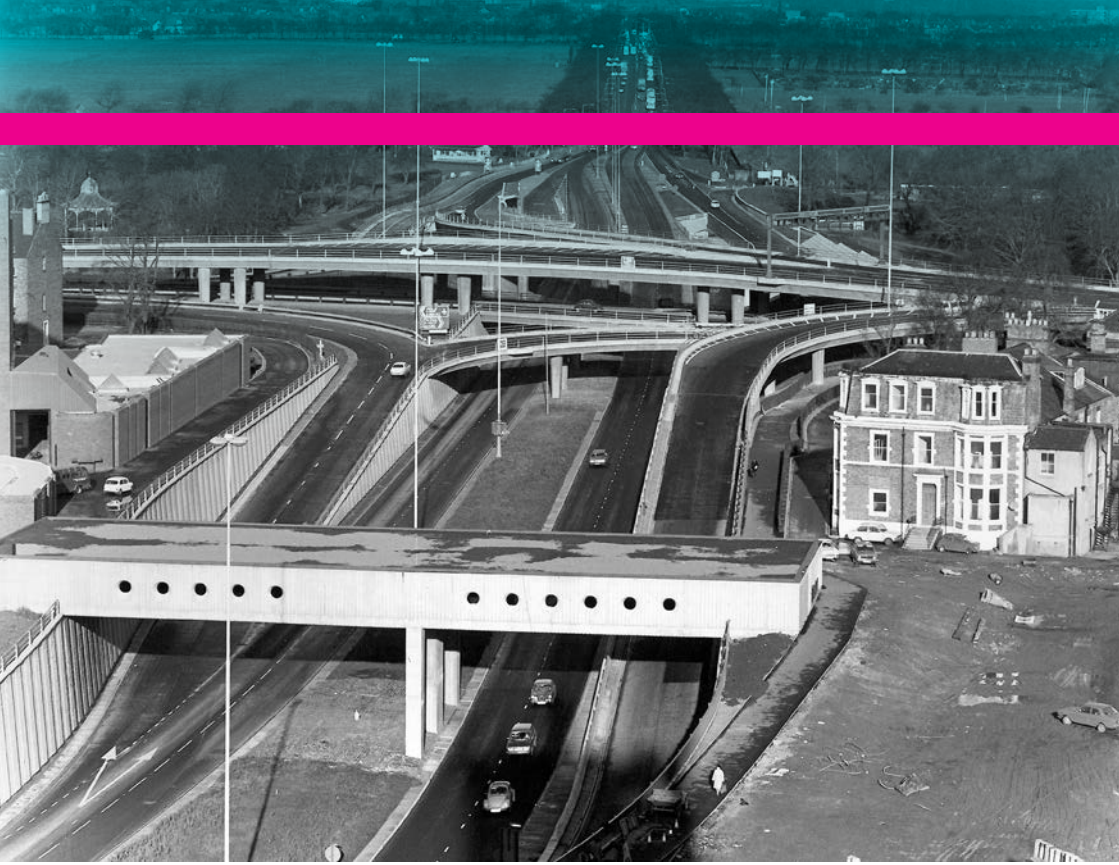
There was however a second public inquiry, in February 1971. Land would be lost at Brandling Park and Exhibition Park and questions were raised about the environmental effects. In August 1971 the Minister decided that adequate provision was being made for public open spaces.

The Central Motorway East contract was awarded to Costain at a tender price of £7m in 1972. The CME opened to traffic in 1975 at a contract out-turn cost of £11.5m and an overall cost of £15m when land and other costs are taken into account. It brought instant congestion relief to the city centre.

The structures were designed by Mott, Hay and Anderson (now Mott Macdonald) and the highways and some of the footbridges by the City Engineers Department of Newcastle upon Tyne. Spoil from the construction was transported to the Town Moor with the approval of the Freemen to form a ski slope. To reduce land take, the motorway was constructed with the north bound lanes elevated over the south bound lanes in the Jesmond section.

There was considerable clearance of terraced areas east of the city centre on the route of the scheme though much of this occurred long before construction took place. These areas were in due course subject to redevelopment, for example by Northumbria University, much of the development actually taking place prior to the road. More apparent change occurred in the Brandling Village area. The road cut through school playing fields. The western end of Jesmond Road which had been the main thoroughfare from the east into the centre of Newcastle became a cul-de-sac, with traffic transferred onto the Sandyford Road into the centre of town.

All of this entailed massive disruption to traffic routes during construction with diversions constantly being changed. To help this situation the City Engineer published a magazine called “Diversion – Newcastle upon Tyne Roadworks Report”. No.1 was published in April 1972 and the final magazine No. 22 was published in August 1975.



If the reader puts ‘Diversion – Building the CME from 1972 to 1975’ into a search engine, all of the copies can be seen with comment and responses from current readers. The ‘ski- slope’ raised much cynical comment. The magazines gave details of roadworks and diversions and changes to bus routes. It also gave photographs of the works in progress including aerial photographs, and artist impressions of the finished works. The magazines are a mine of information about the construction of the CME.

Road structures in particular do not last forever without maintenance and occasional refurbishment. The CME underwent major refurbishment over the period 2000 to 2005 at an overall total cost of £10m. This involved new lighting, concrete repairs, joint repairs, re- waterproofing

and resurfacing. It also involved a significant improvement scheme to the Osborne Road/CME/Jesmond Road junction at a cost of £2.6m in 2003. This replaced small roundabouts with a full traffic signalised junction.

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

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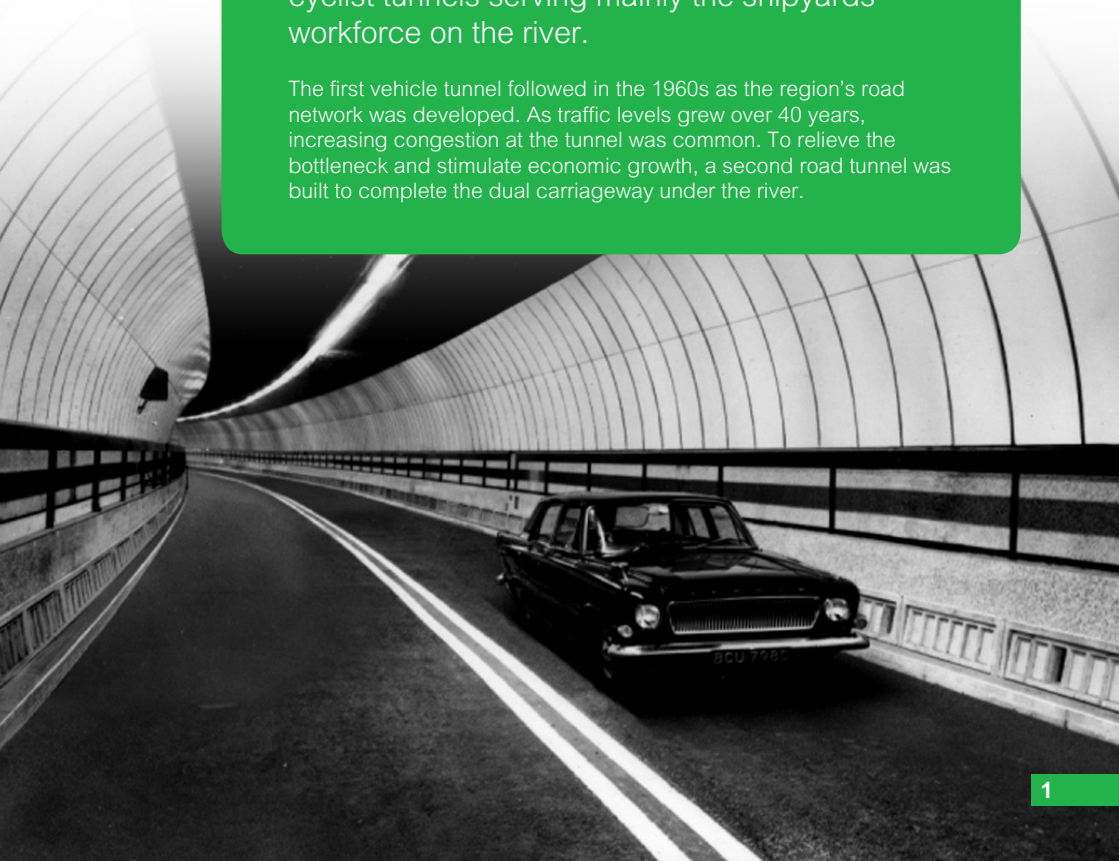
Since the 1950s four tunnels have been constructed to cross the River Tyne, between East Howdon/North Shields and South Shields/Jarrow. The first two were pedestrian and cyclist tunnels serving mainly the shipyards' workforce on the river.

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 in 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.

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.

If you enjoyed this article, try also:

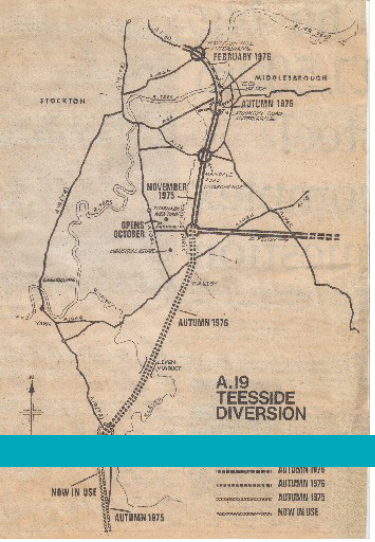
The A19 Trunk Road

The Newcastle Central Motorway East and Other Plans

The A19 Trunk Road

The A19 tends to live in the shadow of the more well known A1 it runs more or less parallel with. However, it is no less important to the region, serving the heavy industry and associated ports of Teesside, Wearside and Tyneside.

Its journey from a single carriageway road linking coastal towns to modern day dual carriageway has been a painstaking process of over 45 years but has brought both economic and visual transformation to the North East.



A Broad History

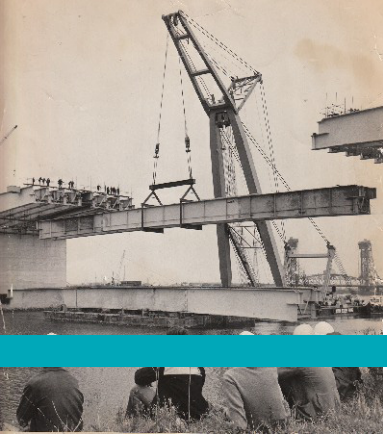
Today the A19 trunk road is a modern all-purpose dual carriageway running from the junction with the A1 at Seaton Burn, north of Newcastle, until it leaves the region south of Middlesbrough. It continues through North Yorkshire to Thirsk and, via a short link (A168), rejoins the A1 at Dishforth. The A19 itself continues as a non-trunk road to Doncaster.

In 1952, the A19 was very different. It existed only south of the River Tyne and was a coastal route of single carriageway and relatively poor standard. Starting at South Shields it passed through Whitburn, Sunderland and Seaham, heading inland through Easington and then back out to the coast via Horden and onto Hartlepool. It then snaked its way through Billingham, Stockton, Eaglescliffe and Yarm.

The improvements in our region towards the route we know today began at the Tyne Tunnel in 1967/8. The tunnel (£13.4m) was built with approach roads from the A1058 Newcastle to Tynemouth Coast Road (£6.5m) in the north and the A184 Gateshead to Sunderland Trunk Road (£3.5m) in the south. This stretch was initially isolated and the Tyne Tunnel route was designated as the A1 until 1991, when the opening of the Gateshead and Newcastle Western Bypasses provided a toll-free alternative across the river. At this point the tunnel became part of the A19 route.

At around the same time, in 1967, the Wolviston to Sheraton dual carriageway (£7.0m) was opened north of Billingham. This was followed in 1971 by three schemes: the Castle Eden Bypass (£3.0m), the Easington Diversion (£7.0m) and the New Seaton to Seaham Scheme (£6.0m). In total, 18 miles of improvements enabled this part of the A19 route to be signposted away from the coast, south of Seaham via the western edge of Billingham.

By 1976 the dual carriageway had been extended a further 8 miles from Seaton northwardsto bypass Sunderland (£6.0m) and join the Tyne Tunnel approach road. The same year also saw the opening of the Teesside Diversion, a £70m scheme of improvements to existing roads and a new dual carriageway routes across the River Tees to connect previous improvements in North Yorkshire. The final piece of the jigsaw came in 1982 with the opening of the 6 mile Billingham Bypass (£16.0m), to the west of Wolviston and Billingham, which completed the A19 dual carriageway in the north east.



Further improvements have since taken place to a number of junctions in County Durham and the Teesside section, between Norton and Parkway, was widened from dual 2-lane to dual 3 and 4-lane in 1998, under the terms of the DBFO contract. Another milestone occurred with the opening of the second Tyne Tunnel in 2011. While the route is dual carriageway standard, some at-grade roundabout junctions remain north of Sunderland – Seaton Burn (A1), Moor Farm (A189), Silverlink (A1058) and Testos (A184). Grade separation of the A19 and the A1058 Newcastle coast road at the Silverlink junction, is scheduled to progress post-2015, and it is hoped the remaining upgrades will eventually follow to complete the continuous dual carriageway between the A1 at Seaton Burn and Dishforth.

Planning and Management

Prior to the 1970s, transport planning in the south of region was fragmented across 13 local authorities under the umbrella of Cleveland County Council and the Department of Transport. The formation of Teesside County Borough (TCB) and commissioning of 'Teesplan' brought about a more coherent strategy and rapid progress on highway improvements followed, including Stage 1 of the Middlesbrough Bypass, the A174 Teesside Parkway and culminating in 1976 with the completion of the A19 Teesside Diversion.

This period of road building however was relatively short-lived, when a further reorganisation in 1974 replaced TCB once again by Cleveland County Council as Highway Authority under a two-tier system. The 'Teesplan' still delivered the Billingham Bypass in 1982 but by then, with the economy in downturn and funding scarce, many road projects remained unfulfilled.

In 1996, the Highways Agency, then responsible for managing the A19 trunk road, let one of the first Design, Build, Finance and Operate (DBFO) contracts to a private consortium – Autolink Concessionaires (A19) Ltd. Over the life of the 30 year contract, the consortium is paid to manage, maintain and, where necessary, improve the route, between the Tyne Tunnel and the A1(M) junction at Dishforth. This arrangement delivered the widening scheme through Teesside in 1998, at a cost of around £40.0m.

A19 Wolviston-Crathorne

The most significant scheme on the A19 during the 1970s, the Wolviston to Crathorne improvement, upgraded roads on the western edge of Billingham and bypassed Stockton and Yarm. It included a new viaduct, crossing over Middlesbrough Road and the River Tees itself. Opened in November 1975, it marked the first new crossing of the river in over forty years, since the Newport Bridge was built in 1934. Today, as then, it dominates the skyline due to it being built so high to accommodate ships into and out of the port of Stockton. However by the time it opened, the port's days were almost over, making the extra elevation somewhat unnecessary.

The viaduct opened on the same day as another substantial piece of Teesside roadway – The Parkway – a four-way free-flow interchange with the A66, still one of the few today on the non-motorway network in the UK. Collectively known as the Teesside Diversion, the two schemes, at a combined cost of £21m was the biggest single local authority project ever completed in the area at the time. It improved the route across and south of the river considerably, giving congestion relief for the communities of Stockton, Eaglescliffe and Yarm.

Maintenance of the highways and structures of the Teesside Diversion, following opening, were to prove problematic. The effect of continuous salt corrosion, especially during the winter months, was severe on the box-girder construction of the viaduct, resulting in regular, expensive repair work. Eventually in 1988, the underside of the deck was completely enclosed in steel and glass-reinforced plastic, to protect the structure from further damage and allow easier access for future maintenance. Crossing the alluvial flood plain of the River Tees also proved problematic, with the poor ground conditions and large increases in heavy commercial traffic causing sections of the pavement to wear out much earlier than expected.

A19 Billingham Bypass

While the Teesside Diversion had opened up the route south of the river, travelling north still remained difficult as the A19 passed through the edge of Billingham on the old bypass constructed in the 1960s. Clearly this was now inadequate for the growing level of demand, especially in the case of heavy commercial traffic. This result was a new, 6mile stretch of 2-lane dual-carriageway to the west of the town. Opened in 1982, it was constructed by Dowsett and designed by the North East Road Construction Unit with Bullen & Partners. It included two grade-separated junctions at the A689 and Stockton Ring Road (Norton). The most significance structure however is the 500m long viaduct which carried the existing Billingham Road over the bypass and Billingham Bottoms. The viaduct was an early example of the use of weathering steel in a major bridge, whereby a protective but non-damaging rust coating is allowed to naturally form on the steelwork rather than preventing rust through continuous painting.

The main carriageway was laid as a continuous concrete surface, a subject of controversy in recent years due to the perceived noise levels. In 2003, the Highways Agency commenced a programme of concrete surface replacement or overlay, with modern quieter materials, on parts of the national trunk road network. However, the Billingham Bypass was not included in this initial programme and users of the road cannot fail to notice the relatively high tyre noise.

The Tyne Tunnels and Approaches

The Second Tyne Crossing opened in 2011, providing a dual 2-lane carriageway for both north and south movements across the river and relieving a significant bottleneck along the A19 route. Accommodating the new tunnel required major alterations to road layout.

The roundabout at the southern entrance was removed and a new interchange connecting the local road network was constructed to provide a continuous A19 through the tunnel. Extending the tunnel portals and highway works some 400m further south brought about significant environmental benefits in reduced noise, improved air quality and enhanced landscape for Jarrow and the immediate local area.

The existing tunnel and the existing toll booths north of the river now serve only northbound traffic. The roundabout at the north entrance was removed and all traffic out of the tunnel flows directly onto the A19. A new toll plaza was constructed for traffic travelling on the southbound carriageway and through the new second tunnel. A dedicated bus lane allows buses to bypass the plaza. All access for local traffic crossing the river was diverted onto the A19 further north at the A193 Wallsend to North Shields road junction.

In total this has produced a free flowing entrance and exit to the tunnels and experiences in the early days indicate that the once notorious queues have been eliminated.

Thanks to Tony Robinson of CIHT North Eastern Branch, for preparing this article. Tony is a Transport Planner at Jacobs UK Ltd, in Newcastle upon Tyne

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The A1 Trunk Road

The A1 is the UK's longest numbered road, dating back to the 1920's, when it reflected the importance of the link between London and Edinburgh.

In 1952, the Great North Road passed through the region's towns and city centres – local and through traffic sharing the same space with pedestrians in Darlington, Durham, Gateshead and Northumberland Street in Newcastle. Further north, it was forced through pinch-points such as the ancient Bondgate Tower in Alnwick.

Sixty years later, the A1 has been replaced by the A1(M) motorway in County Durham, while Tyne & Wear and Northumberland has seen gradual improvements (and diversions) to the route. It remains the primary road link north and south of the region, despite its mix of improved and unimproved sections.

A1(M) in the North East

The principle of a new A1 trunk route through County Durham was first established in the 1930's with the building of bypasses for Birtley and Chester-le-Street, along with plans for a Darlington bypass. That proposal didn't come to fruition until 1956 when the bypass was included in the national network of new Motorways by the Ministry of Transport. Construction commenced in 1961 and included 10.5 miles of motorway between Darlington and Barton, a two mile spur road into the town, 9.5 miles of load road reconstruction and 34 bridges. It was opened in May 1965 at a cost of £6.5m.

Design work on a further 22 mile stretch of the 'Durham Motorway', between Darlington and Chester-le-Street, started in 1958 with construction broken down into four sections, each costing between £3m and £4m. The route opened fully to traffic in September 1969 and included a total of 60 bridges and two major structures – Lumley Dene Bridge, a steel arch box-girder construction spanning 330 feet across and 80 feet above a valley of considerable natural beauty, and the River Wear Bridge at Chester-le-Street with a reinforced concrete span totalling 345 feet.

North of the Durham Motorway, the Birtley bypass was completed in 1970 – a 2.5 mile stretch that followed the same alignment as the improvements of the 1930's and, at the time, was the only 3-lane motorway north of the M1. Around the same time also saw construction of the White Mare Pool to Black Fell scheme, which extended the A1(M) to the Tyne Tunnel. Just a few miles further north, the completion of the Gateshead Western Bypass, in 1974, marked the start of the A1 route as we know today, and which was eventually extended as part of the Newcastle Western Bypass in 1990. Upon that scheme's opening, the A1(M) to the Tyne Tunnel was re-designated the A194(M).

The A1(M) schemes mentioned above were the first contracts prepared and supervised by the Durham County Council Sub-Unit of the North Eastern Road Construction Unit – a body which subsequently managed the design and construction of many trunk road and motorway schemes, from Berwick in the north to the M62 in the south.

While large-scale improvements have been ongoing to the A1 in neighbouring North Yorkshire since the mid 1990s, there has been little change in County Durham since the original schemes were completed, save for limited widening to accommodate overtaking lanes at steeper gradients. Despite this, the network has served the North East effectively for over 40 years.

A1 Newcastle Western Bypass

A significant scheme in every way – the Newcastle Western Bypass was, at the time, the most important project in the national trunk road programme, seen as key to unlocking improved road conditions and economic growth in the north. First suggested in 1936, it was featured in development documents from 1945, but not added to the Trunk Road Programme until 1977. The preferred route was announced in 1981, modified in 1984 and Statutory Orders published in 1985. Despite 200 objections to the scheme, the subsequent public inquiry lasted only 10 days.

The total cost of the scheme was £117m and attracted a European Regional Development Fund grant of £23m – the largest to be awarded in the UK at that time. A ceremonial sod cutting on 24th April 1987 by then Secretary of State for Transport, John Moore, marked the start of a three year construction project, split across four contracts, delivered by Balfour Beatty Construction Ltd, Cementation Projects Ltd, Edmund Nutall Ltd and Peter Birse Ltd. Consulting Engineer was Bullen & Partners, along with Landscape Architect Anthony Walker & Partners.

The scheme comprised of an 11km dual two and three lane carriageway and provided a direct link between the Gateshead bypass and the A1 at Gosforth, including seven grade-separated junctions. The most significant feature is the Blaydon Bridge and Blaydon Haughs Viaduct which crosses the River Tyne, the A695 Chain Bridge Road and the Newcastle to Carlisle railway towards the Metro Centre shopping complex. The bridge design – a pre-stressed concrete box structure – was subsequently accepted by the Royal Fine Art Commission. Another major structure was the Fawdon railway bridge, which carries the Metro over the bypass. This was constructed offline and slid into position over the course of one 30 hour possession period.

The Blaydon Bridge was officially opened by Her Majesty the Queen on 1st December 1990, following in the tradition of bridges over the River Tyne being opened by a member of the Royal Family – before and since. Upon completion of the full scheme, the route of the A1 trunk road was signposted away from the Tyne Tunnel at Birtley and onto the Gateshead and Newcastle Western Bypass, eventually linking up to its old alignment at Seaton Burn, with what is now the A19 junction.

Newcastle to the Scottish Border

The first significant improvements to the A1 between Newcastle and the Scottish border saw the openings of the Seaton Burn, Blagdon and Morpeth bypasses in 1970. Built to 2-lane dual carriageway standard the schemes marked the start of a 15 year period of upgrades. A bypass of Alnwick (also 1970) was followed by Warrenford (1978), Felton (1981), Belford and Berwick-upon-Tweed (1983). However these were single-carriageway improvements as traffic flows on the A1 further north in Northumberland did not justify the cost of dualling. It highlights the contrast between 1970s and 1980s approach to upgrading the road, the former presumably more policy-led, the latter emphasising cost-benefits, as the economic appraisal of schemes came to the fore.

Despite it no longer being a matter of course, the Stannington Bridge to Clifton improvement (1987) was economically justified to complete the dual-carriageway between Newcastle and Morpeth, as was a small improvements at Brownieside, north of Alnwick, in 1993.

A1 Berwick Bypass and Tweed Bridge

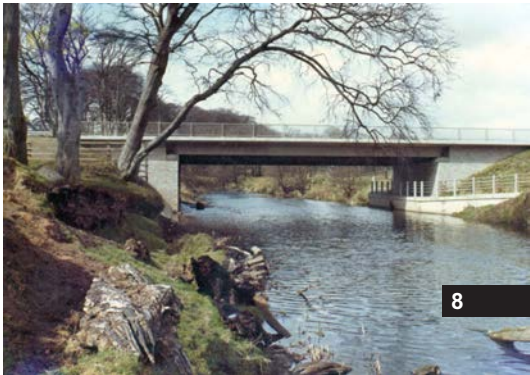
Designed and supervised by the DCC Road Construction Sub Unit, this scheme was completed in 1983 at a cost of £9.5m. Its main structure is the 195 metre River Tweed Bridge, with four spans, including a maximum span of 56m. Temporary piers were constructed within steel sheetpile cofferdams on both sides of the river; the bridge deck was assembled on the south bank and launched across the river using an attached nosing girder.

Route Management and Future Improvements

In 1999 the Highways Agency published a Route Management Strategy for a ten year period, which advocated the continued approach of localised dualling and traffic safety improvements. Borne out of this was the Willowburn to Denwick improvement (2003), which dualled 4km of single carriageway east of Alnwick, and a grade separated junction at Stannington (2004), which allowed four central reservation crossings to be closed, a permanent 50mph speed limit to be lifted and mitigated severance between the west and east sides of Stannington village.

Two further dualling schemes, Morpeth to Felton, and Adderstone to Belford were in advanced stages of preparation until funding pressures on the North East Regional Transport Board saw them dropped in July 2006. Nearly five years later, the A1 through Northumberland was reclassified to a route of national strategic importance, meaning any further improvements would now be funded centrally by the Department for Transport.

Campaigns to complete the dualling of the A1 through Northumberland, on both economic and safety grounds remain vigorous.



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