

ArupTransport

Tyne & Wear Passenger
Transport Authority

New Tyne Crossing

Scheme Description
Report

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Scheme Description Report

May 2002

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CONTENTS

	Page
1. INTRODUCTION	1
2. SCHEME DESCRIPTION	2
2.1 Northern Highways - Existing A19 Metro Overbridge to Northern Tunnel Portal	2
2.2 Tunnel Section (North Tyneside)	3
2.3 Immersed Tube Construction in the Tyne	4
2.4 Tunnel Section (South Tyneside)	5
2.5 New Road Connections (South Tyneside)	7
3. CONSULTATION	9
4. STATUTORY UNDERTAKERS WORKS	10
5. CONSTRUCTION PROGRAMME	11
5.1 Introduction	11
5.2 Indicative Tunnel Programme	11
5.3 Indicative Programme for Highway Works	12

APPENDICES

Appendix A

TWA Plans and Schedules

Appendix B

Existing and Proposed Structures

Appendix C

Schedule of Statutory Undertakers Equipment

Appendix D

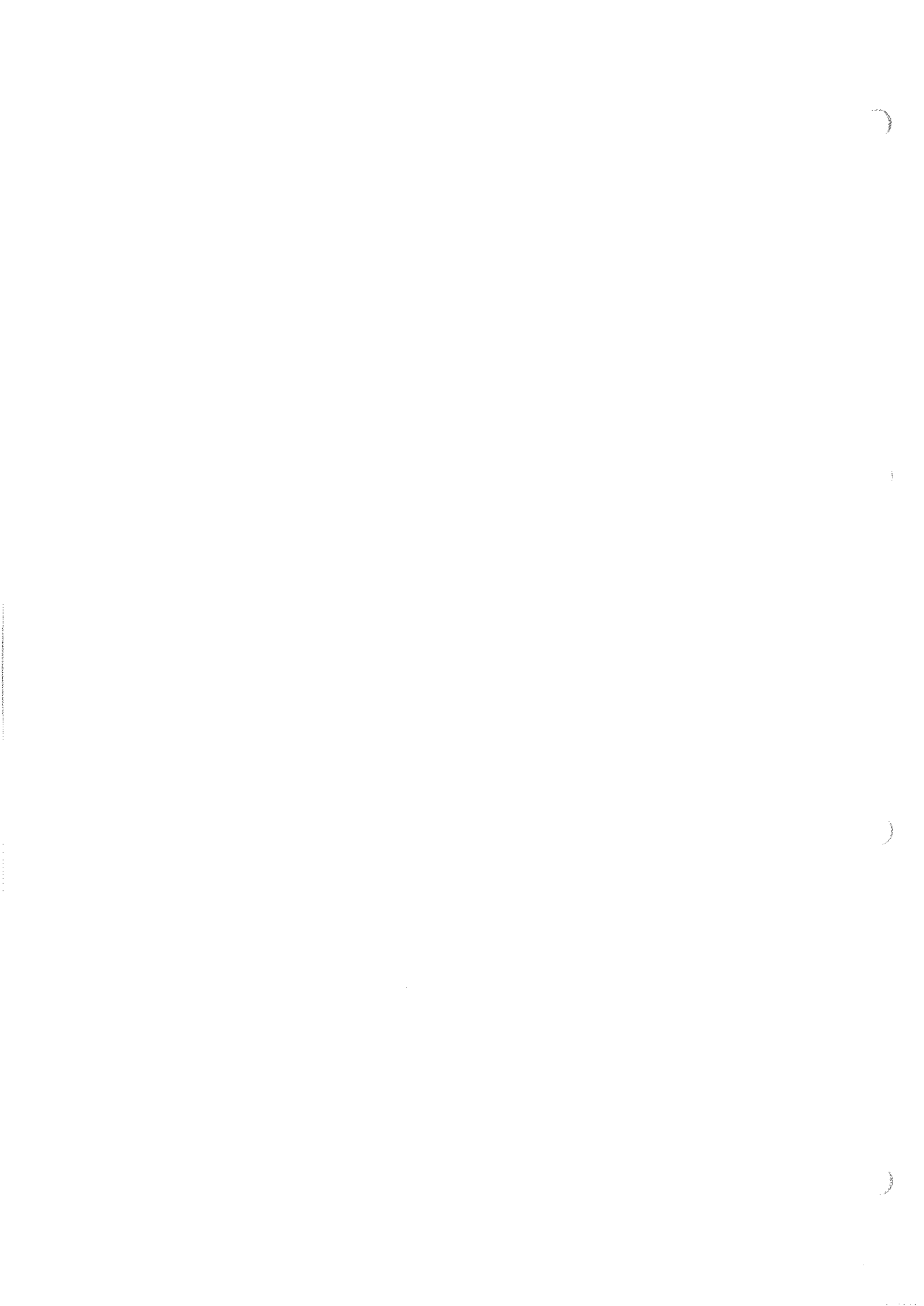
Typical Carriageway Cross Sections

Appendix E

Typical Tunnel Cross Section

Appendix F

Indicative Construction Programme



1. INTRODUCTION

The construction of a second crossing of the River Tyne has been a policy objective of the Tyne and Wear Passenger Transport Authority, (TWPTA), since the 1980's. Consideration of potential alternative locations and crossing types for a new Tyne Crossing started in 1990 and it has been the subject of a number of studies and assessments since that date that are considered in section 2 of the Environmental Statement. These studies culminated in the resolution by the TWPTA in May 1996 to progress with an immersed tube tunnel under the Tyne adjacent to the existing tunnel at St Bede's.

The TWPTA promoted a Parliamentary Bill in 1998 to permit the income from the tolls to be used to promote the building of a new crossing; this Bill received Royal Assent on 9th April 1998.

The Arup Consortium (Arup, Posford Duvivier (now Royal Haskoning) Herbert Smith KPMG) and Lamb & Edge were appointed as advisors by the TWPTA. The role of the advisors is to identify and secure all expert advice and services and to appoint a Concessionaire, who will operate the existing tunnels and design, finance, build and operate the new tunnel. The advisors were also appointed to support the TWPTA through all the statutory processes of the application for an Order under the Transport and Works Act 1992.

The TWPTA are now making an application to the Secretary of State for Transport under the Transport and Works Act 1992, seeking the powers needed to implement the proposal. If the Order is confirmed the TWPTA will seek to appoint a Concessionaire under a Public-Private Partnership (PPP). They will finance, design, build and operate the new tunnel they will also take over responsibility for the existing pedestrian, cycle and vehicular tunnels for a concession period. During the concession period, the TWPTA will continue to oversee the tunnel operations. At the end of the concession period the tunnels will revert to the TWPTA.

This report has been prepared by the advisors to describe the scheme proposals and should be read in conjunction with the accompanying plans and sections, and the Environmental Statement, which form part of the application for the Order.

The following documents are appended to this report:

Appendix A – TWA Plans and Alignment Drawings

Appendix B – Existing and Proposed Structures

Appendix C – Schedule of Statutory Undertakers Equipment

Appendix D – Typical Carriageway Cross sections

Appendix E – Typical Cut and Cover and Immersed Tube Tunnel Sections

Appendix F – Indicative Construction Programme

A Construction Cost Report has also been prepared which includes build-up sheets for the Scheme. This document is not included in this report.



2. SCHEME DESCRIPTION

2.1 Northern Highways - Existing A19 Metro Overbridge to Northern Tunnel Portal

Appendix A contains the Drawings that illustrate the Work numbers described in the text below. Appendix D shows a series of illustrative cross sections at various stages along the route.

The proposed works commence immediately south of the existing Metro Bridge (Existing Structure E1a Appendix B) which lies on the section of the Metro line between the North Shields and Percy Main Stations. Currently from this point the A19 descends through a shallow cutting due south to the existing roundabout junction at the northern end of the tunnel. This junction permits access to the tunnel and the local highway network (Tyne View Terrace and East Howdon by pass) for traffic travelling in both directions.

The proposals consist of a new toll plaza (Work 1B) for use by all southbound tunnel traffic and amendments to over 0.5km the northbound and southbound carriageways of the A19 trunk road. This will involve the widening of the existing A19 southbound carriageway from 7.3metres to 10.5metres, giving an overall width of 55metres to accommodate the new deceleration lane into the proposed toll plaza vehicle inspection area. The proposed carriageway profile over this length is the same as the existing A19. The existing footbridge, which crosses this section of the A19 is owned by North Tyneside MB Council and will be unaffected.

Over this length the highway will change from open cut to retained cut with retaining walls on either side as it descends below existing ground levels at a gradient of 6% to the tunnel portal. A new Administration Building (Work 1E) and staff parking areas will be constructed in the open cut area adjacent to the proposed toll plaza. A new access to this area will be built for tunnel staff from the A187 Howdon Bypass and access to the A187 Howdon Bypass for rejected tunnel traffic (Work 1D). The local highway network will be altered and a new dedicated public transport link will be formed between Howdon by-pass and the new toll plaza allowing better and more direct public transport links through the new tunnel (Work 1C). All of these features are to be constructed by cutting into existing ground. The deepest cutting will lie between works 1E and 1G, the southern edge of the Administration Building and northern edge of eastern retaining wall at the tunnel portal. Here the cutting will be 9m deep with side slopes of 1:4.

A new crossover area for emergency vehicles is proposed between the north and southbound carriageways of the A19, forming a 13metre long east/west link between the two carriageways (Work 1F).

In the Order proposals, Work 2 consists of amendments to the existing toll plaza and the northbound A19 trunk road carriageway. Work 2A is the widening of the existing A19 trunk road over a length of 793m to accommodate northbound traffic exiting the tunnel. Over this length the highway maintains the same level and gradient of the existing carriageway.

Work 2B is a crossover between the north and southbound carriageways. It commences 8m south of the existing Metro Bridge (Existing structure E1a Appendix B) and extends 100m south from this point. At this location both north and southbound carriageways follow the same level and gradient as the existing A19.

Work 2C is the realignment of the existing toll plaza. This involves reconfiguring the existing layout to accommodate new tollbooths. Widening of the existing hard standing will be required at several location within this area. All works will be carried out to match existing levels.

Work 2D involves minor amendments to the existing carriageway and surface levels to create an alternative route for south bound traffic when the existing tunnel is switched to two way traffic operation. These works are located on the southern end of the existing A19 and the existing roundabout at the northern tunnel entrance.

Work 2E is the construction of an at grade link to enable northbound tunnel traffic to access the local traffic network at the southern end of the Howdon Bypass. It comprises realignment of existing carriageway and re-use of the same where possible. Existing levels and gradients should not be changed significantly.

Land to be acquired north of Work 1C and 1D, east of Work 1A and 1B and to the west side of the Howdon Bypass is for land filling and landscaping purposes. Land acquired within the limits of Work 1E is to facilitate construction of the said Works and associated landscaping. All other land acquired is for construction purposes.

Temporary possession of public highway is required on the Howdon Bypass to access the works and construct Works 1G and 3 (See 2.2 Below).

Relevant Plans

Order: OA-CL-500

OA-CL-501

OA-CL-502

OA-CL-503

OA-CL-504

2.2 Tunnel Section (North Tyneside)

The approach road to the northern entrance to the new tunnel will swing eastwards towards East Howdon bypass and the tunnel entrance will be immediately to the west of the bypass approximately opposite the midpoint of Brinkburn Street. The tunnel will then cross over the existing tunnel at an angle of approximately 23° before swinging south towards Howdon Basin.

In the Order proposals, Work No. 3A comprises the length of tunnel between the northern portal and the northern end of Howdon Basin. This length of tunnel will be constructed by the cut and cover method with special measures being required at the crossover of the existing tunnel. The cut and cover section on the north side of the river will require excavation down to approximately 20m below ground level and will extend from the north edge of Howdon Basin to just north of the southern crossover of the existing bored tunnel.

Concrete diaphragm walls will be installed to prevent the collapse of the sides and damage to nearby structures. Once the parallel diaphragm walls have been installed, excavation will take place between these using grabs and hydraulic excavators. Excavated material will be used as backfill with surplus material taken away to tip or re-use in other works.

The base of the cutting blinding concrete and reinforcements will be installed for the slab base. Backfill will be compacted over the concrete box. Once the tunnel structure is complete it will be fitted out with round surfacing, ventilation fans, lighting, fire protection, fire fighting pipework, drainage and control systems. A watertight bulkhead will be fitted to the end of the cut and cover section to enable a seal with the immersed section of the tunnel.

To provide working space to construct the new tunnel in the vicinity of the north portal, it is proposed to take temporary possession of the northbound carriageway of East Howdon bypass.

To allow construction of the tunnel and to provide access for the contractor, the link road between the roundabout at the south end of East Howdon Bypass and the A19 roundabout adjacent to the existing tunnel entrance will be closed throughout the construction period. Access along Tyne View Terrace will be maintained throughout the construction period although traffic and pedestrian diversions will be required.

Construction of the tunnel within Howdon Yard between Tyne View Terrace and Howdon Basin will require demolition of existing buildings, diversions to services and the provision of a replacement electricity substation. A working area to construct this section of tunnel will require temporary possession of land on each side of the tunnel within Howdon Yard.

Site access to Work 3A north of Tyne View Terrace will be from the north via the land between the A19 and East Howdon Bypass and from the closed off access road between the A19 roundabout and the East Howdon Bypass roundabout. Site access to Work 3A within Howdon Yard will be via two entrances off Tyne View Terrace. Work 3B is an escape shaft from the existing tunnel

Construction of the tunnel within Howdon Yard will divide the yard into two parts, Howdon Yard East and Howdon Yard West. Access to Howdon Yard East will continue through the existing entrance of Tyne View Terrace. Access to Howdon Yard West will be via a new access off Tyne View Terrace and via a new access off Coach Open adjacent to the northern entrance to the Pedestrian and Cyclist Tunnels.

Within Howdon Basin the tunnel will be installed inside a temporary cofferdam structure. The cofferdam will minimise the extent of dredging required in the basin and protect the existing quay structures from being undermined. A widened cofferdam may be used as a temporary building dock to construct the concrete elements that will form the immersed tunnel.

On completion of the installation of the immersed tunnel within Howdon Basin the existing piled quay structure to the east of the tunnel will be extended westwards over the tunnel. This will provide protection to the tunnel and allow the continued ability to maintain a 6.2m deep berth on the east side of Howdon Basin.

The extension of the quay on the east side of Howdon Basin will reduce the width of the basin. The basin will be reconfigured by widening on the west side with a new quay wall to maintain the existing width. An additional length of quay edge (Work No.4C) will also be provided east of Howdon Basin. Work No.4D will provide further protection to the immersed tube tunnel in the river channel on the south side of the basin.

Works to the Howdon Basin are included within the Order proposals Work No.'s 4B, 4C and 4D.

2.3 Immersed Tube Construction in the Tyne

In the Order proposals, Work 4A extends from the north of Howdon Basin to the mid-river boundary line between North Shields and Jarrow and Work 5 extends from the mid-river boundary line to the south bank of the river. The tunnel will be constructed by the immersed tube technique within Howdon Basin and the Tyne. Within the river a trench will be dredged to accommodate the immersed tunnel. Some of the material dredged from the trench will be suitable for use as backfill when the tunnel is installed. The Order proposes that land is acquired or used at the former Mercantile Shipyard site for temporary storage of dredged material.

The immersed tunnel will be formed as a number of concrete box elements that will either be constructed in a temporary building dock in Howdon Basin or in a drydock offsite. The limit of land to be acquired or used in the Order encompasses an area upstream of the tunnel to allow for temporary storage of tunnel elements in the river. The tunnel elements will be

installed either directly from the building dock or from the temporary storage areas. The elements will be manoeuvred into position using tugboats or equivalent and lowered into the immersion trench by winches from beams spanning between catamaran barges.

The tunnel elements will be bedded on sand or gravel. Backfill will be placed around and over the tunnel and the top of the tunnel will be protected by a stone armour layer within the navigation channel and up to Howdon quay.

Once the immersion is completed and access gained into the immersed tunnel from the cut and cover sections, the internal works on the tunnel will be undertaken, as described above.

The new tunnel will provide a 7.3m wide two-lane carriageway with 1.0m wide verges on each side of the carriageway. A maintained headroom of 5.1m will be provided over the carriageway. Space above the maintained headroom will be provided to accommodate flapping tarpaulin covers, ventilation fans, lighting fixtures and signs. The sides of the tunnel will be protected from vehicle impact by step barriers. Appendix E shows a typical cross sections through then tunnel.

The vertical alignment has been designed to meet the constraints imposed by navigation requirements in the river and the existing A19 road alignments on the north and south sides of the river for a design speed of 56 km/hr. The road gradient on the north side of the river will not exceed 6% (downhill for normal uni-directional traffic flow). The road gradient on the south side of the river will not exceed 5% (uphill for normal uni-directional traffic flow).

A separate escape/services passage will be provided along the whole of the eastern length of the tunnel. This will provide emergency access from the verge at the side of the inside lane. The passage will be divided into three zones; Zone 1 below the walkway floor will accommodate pipes for water supply and drainage; Zone 2 will provide a 2.5m high walkway escape passage; Zone 3 above the escape passage will provide a cable passage for power and communication cables. Access from the traffic cell to the escape passage will be via emergency doors at not more than 100m intervals.

2.4 Tunnel Section (South Tyneside)

The cut and cover section on the south side (Work 6A) will be between 12metres and 30metres below ground level. The construction process will be as described above for the cut and cover section on the north side. The cut and cover section on the south side extends from the south bank of the river to adjacent to the existing tunnel south portal. An open cut section of the tunnel will be constructed, extending south of the southern portal to the south side of the new Howard Street bridge.

The ground behind the existing east side retaining wall will be excavated and battered back towards Stothard Street. It may also be necessary to carry out excavation behind the existing west side retaining wall to balance loads on the existing structure. A reinforced concrete box section approximately 130metres long will then be constructed in the open behind the existing retaining wall. Following completion of this section, backfill would be placed over the box up to existing ground level and behind the existing concrete retaining wall that retains the cutting immediately south of the existing tunnel.

The southern end of the new tunnel box section would be utilised as the abutment structure for the new bridge for Howard Street, thus reducing the bridge span to that of the A19 northbound carriageway only.

The existing area of hard and soft landscaping (Riverside Park) between the Tyne and Chaytor Street will be removed as part of the regrading works. As part of this work the Charles Palmer monument that is in the Park will be restored and subsequently relocated to a site in Jarrow High Street, opposite the Town Hall. The Gaslight Public House, a grade 2 listed building, and the adjacent car showroom will be demolished to accommodate the tunnels

works in this area. A number of other properties will need to be demolished as part of the works including the Grange Nursing Home, St Peters Infant and Junior School, Dunn Street School Playing Fields, as well as fifteen residential properties and two shops on High Street, Stanley Street, Salem Street and Commercial Road

Access along Chaytor Street and High Street will be maintained throughout the construction period, although temporary traffic and pedestrian diversions will be required.

Following completion of the construction works the area will be re-graded and produce a uniform gradient rising at 1 in 20 from the Quayside Walkway and appropriate landscaped in accordance with a scheme to be agreed with the Local Authority. The Quayside Walkway will remain in its current location. South of Chaytor Street these landscaping works will extend south to the new road between Ferry Street and Friar Way with a narrower strip extending further south as far as the tunnel portal at Howard Street.

A series of new access roads / pedestrian routes are proposed as part of the scheme:

7.3m wide access road (Works 6B and 6C) from a new roundabout on Chaytor Street (Work 6D) to the entrance to the existing pedestrian/cycle tunnel. This access road will tie in to levels on Chaytor Street and extends northwards towards the river descending at a gradient of 1 in 20. It will reach its lowest point adjacent to the river walkway before looping back to tie back into Chaytor Street. It has been designed to allow buses to turn in this location, which is proposed as a possible new site for a ferry terminal.

A new 7.3m wide link road will be constructed between Ferry Street and Friar Way (Work 6F). This road will tie into existing levels at each end and, in between will have minimum gradients for drainage purposes.

New footpath/cycleways will be provided to link the Quayside Walkway and pedestrian / cycle tunnel to a new pedestrian crossing on Chaytor Street.

A new turning head will be provided where Curlew Road is stopped up and replaced with the footpath cycleway described above.

A new footpath/cycleway will be constructed to link the new crossing at Chaytor Street to link road will be constructed between Ferry Street and Friar Way. Proposed ground levels over this section of the works will be similar to existing.

Stanley Street, will be closed permanently as a result of the works and replaced with the new link road between Ferry Street and Friar Way. A new turning head will be provided where Stanley Street is to be stopped up.

High Street will generally remain open for the duration of the Works other than for the construction of a temporary bridge to enable the passage of traffic.

Salem Street will be generally be closed for the duration of the works other than when High Street is closed to construct the temporary bridge.

Work 6E is an escape shaft from the existing tunnel.

A new overbridge will be constructed at Howard Street immediately to the north of the existing bridge. The tunnel south portal will be approximately 12 metres beyond the south side of the new bridge

A new ventilation building will be constructed west of the tunnel, south of the new Howard Street bridge. The proposed dimensions of this building are 20metres x 25metres. The ventilation stack will be 15metres high and the surrounding building 7metres high.

The existing tunnel is to be extended by approximately 50m at the south end by covering over the sunscreen louvers that prop the retaining walls.

2.5 New Road Connections (South Tyneside)

The tunnel portal on the south side of the River is approximately 14 metres south of the new Howard Street overbridge. Southbound traffic exiting the tunnel wishing to access the local highway network to travel to Jarrow or South Shields could do so via a new slip road, Work 7L, that will link the A19 south bound to a new roundabout junction on the A185. This roundabout junction, Work 7S, will facilitate access to either Jarrow or South Shields. Traffic wishing to travel to South Shields will continue straight ahead along the A185 toward south Shields via Work 7T. Traffic wishing to travel to Jarrow will turn left at this roundabout onto a further realigned section of the A185, Work 7M, to the reconfigured roundabout, Work 7E, at the junction of Howard Street and Priory Road. From here traffic can access Jarrow to the east via Priory Road and Work 7F, or to the west via a new overbridge and realigned highway on Howard Street, Work 7G, 7H and 7J.

Traffic from the local highway network (Jarrow and South Shields) wishing to access the Tunnel for travel northbound will do so via the reconfigured junction, Work 7E. From this junction a new access road, Work 7D links to a new A19 overbridge Work 7C. The new link road will be three lanes wide: two lanes travelling south and one lane travelling north. Traffic descending the spiral (Work 7B) to access the A19 northbound will have to move into an appropriate lane. Heavy goods vehicles will be required to use the inside lane to access Work 7Q, the vehicle inspection area. Rejected vehicles will be directed into Work 7Q and then turned back onto the A19. Traffic signals will be used to effect this operation as presently. All other traffic will use the outside lane to gain direct access to the A19. All north bound traffic using the spiral will be required to give way to heavy vehicles which will be required to leave the A19 to access the vehicle inspection area.

A new slip road from the northbound carriageway of A19 will enable access to the vehicle inspection area for heavy goods and the south bound spiral for traffic wishing to access the local highway network rather than the tunnel (Work 7R).

Traffic exiting the tunnel not wishing to access the local highway network will be able to continue south via, a new section of dual carriageway which passes below the existing Mineral Railway and Metro Bridges to tie into the existing A19 just south of the Metro Bridge (Work 7K).

Traffic coming from South Shields or Jarrow wishing to access the A19 south bound will be able to do so via the new roundabout junction on the A185 and a new link road and slip road onto the A19 from the roundabout junction on the A185 (Works 7U and 7V).

North bound traffic will access the tunnel via a new section of 7.3m wide dual carriageway, commencing on the existing A19 just south of the existing Metro overbridge and continuing north to the tunnel portal (Work 7A).

Northbound traffic wishing to access the local highway network and local traffic wanting to access the tunnel will be able to do so via a new compact grade separated junction, known as the Jarrow Junction (Works 7B, 7C and 7D). Traffic would leave the A19 south of the existing Metro overbridge and travel onto a single lane carriageway travelling clockwise around the spiral junction. At the end of the new A19 overbridge the carriageway extends anticlockwise around a compact spiral arrangement as Work 7B. The rate of descent around the spiral is 1 in 20. This takes the carriageway down to the same level as the A19. A retaining wall (Work 7P) with a maximum height of 6 metres is required to support the land above the outside of the spiral to the east of Epinay Walk.

This carriageway terminates at the reconfigured roundabout at the junction of Howard Street and Priory Road. Access to Jarrow and South Shields will be achieved via this junction.

Part of the new A19 dual carriageway, on the north side of the existing Mineral Railway line will need to be supported on structures, due to the nature of the ground in this area. These

structures will generally be below ground level and will not be apparent to road users. (Works 7A and 7K).

Relevant Plans

Order: OA-CL-500

OA-CL-504

OA-CL-505

OA-CL-506

OA-CL-507

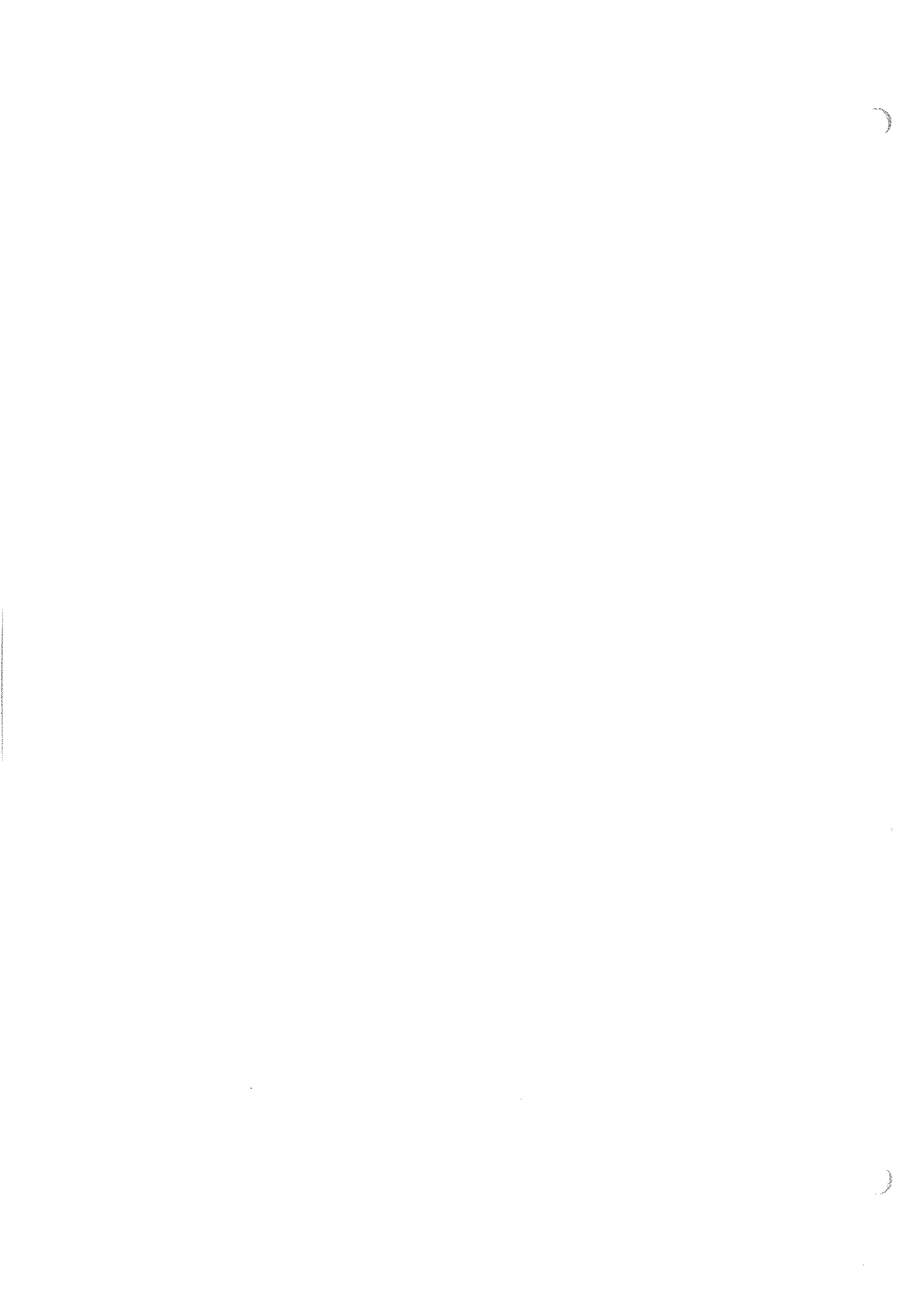
OA-CL-508

OA-CL-509



3. CONSULTATION

Over the course of their development the proposals outlined above have been subject to consultation with various public bodies and organisations as well as members of the public. Particular aspects of the scheme that were influenced by the consultation exercise include the junction arrangements on the north and south sides of the river. These have been developed following consultation with the respective local authorities, the Highways Agency and members of the public via a series of public exhibitions.



4. STATUTORY UNDERTAKERS WORKS

Major utility diversions will be required over the extent of the works. The locations of all affected utilities are included in Appendix C. An advance works package has been included in the indicative programme (shown in Appendix F) to enable the majority of the service diversions to be carried out prior to the commencement of the cut and cover works. Services will be diverted into dedicated service crossings at various points along the length of the route. The diaphragm walling that is required to support the sides of the cut and cover sections of the tunnel will have to accommodate these crossings. Bridging structures will be required to support the services across cut and cover sections. These are likely to be in the form of piled ground slabs although the final detail will depend on detailed design and further consultation with statutory undertakers. A plan showing the indicative position of dedicated service crossings is included in Appendix C.



5. CONSTRUCTION PROGRAMME

5.1 Introduction

The indicative construction programmes for the tunnel and associated highway works for the scheme is Appendix F of this report.

5.2 Indicative Tunnel Programme

An indicative construction programme has been developed to illustrate the Tunnel works portal to portal. The overall construction period of 36 months includes four months of commissioning.

The limitation imposed by the Environment Agency that dredging of the immersion trench should take place between the beginning of November and the end of March means that the immersed tube works are sensitive to the time of year that construction commences. To determine the effect on the programme of the start date four programmes were prepared with three month intervals between start dates.

These four programmes showed that the period of float in the programme from the time that the final elements are constructed and immersion commences varies at the expense of the reduction in period for fitting out and commissioning once the immersed tube units are installed and "link up" from north to south achieved.

The preferred date for commencement of the programme that emerged from this exercise is April 2004. This gives a full 10 months for Fitting Out and commissioning whilst providing three months of float for the 14 month tunnel element construction works.

Cut and Cover Programme

The programme is based upon the assumption that two diaphragm wall machines are mobilised for the south side cut and cover section 2. After which one machine works on the diaphragm walls for sections 1, 3 and 4 and the other machine moves to the cut and cover works north of the river. Assumed diaphragm wall production rates vary from 17m to 20m in length on plan per week depending on the depth of the wall panels.

Excavation and backfill operation of the cut and cover works have been programmed to be concurrent to minimise storage of material. Excavation rates assumed are 750m³ to 1000m³ per day per crane depending on depth of excavation within 2 No. cranes operating simultaneously.

Concrete construction rates for the cut and cover tunnel are based on an assumed until length of construction of 25m. It has been assumed that a week is required for construction of each section of floor, walls and roof. Taking into account the delay between pouring floor/walls and wall/roof of 3 and 2 weeks respectively a period of 8 weeks is required to construct a 25m long section of tunnel. This equates to 11 weeks for a 100m long section and 15 weeks for a 200m section of tunnel.

Dredging Programme

A programme for dredging of the immersion trench has been prepared based upon rates for grab dredging of alluvial clay and backhoe dredging of sands and gravels, glacial clay and bedrock.

A 4m³ capacity grab has a considered loading 300m³ capacity dumb barges for shore disposal. These will be unloaded at the shore (Mercantile Dock) by an excavator and the material placed in large open-topped storage bins. Lime/cement will be added to the material in suitable proportions and well mixed. The treated material will be removed by truck in a dry

state to local disposal sites. Approximately nine to ten 20 tonne trucks per hour would be required to transport the treated material to the tip. The output of the grab is estimated to be approximately 13,500m³ per week. Hence a period of 30 - 40 days is required to dredge silts, made ground and alluvial clays.

The backhoe will load barges for transport of material for storage or disposal at sea. Storage of sands and gravel is envisaged at Mercantile dock site. Off loading of the barges will be carried out using two 6m³ grabs.

The total dredging period calculated is 12 weeks (seven day working week). An additional six weeks has been added as a contingency for bad weather and breakdowns given that the dredging is taking place through the winter.

Immersed Tube Tunnel

The construction periods adopted for construction of the building dock, construction of the tunnel elements, immersion and backfilling of tunnel elements have been based on previous immersed tube projects.

Fitting Out and Commissioning

The assumed time scales for fitting out are based upon previous projects. This work can take place more efficiently once the tunnel civil works is complete and access from one side to the other is possible.

5.3 Indicative Programme for Highway Works

The timescale assumed for the highway works and the various structures required to support the same are based on previous experience.

Certain enabling works will be required to be undertaken prior to the main highway works and some of the tunnelling works being carried out. These include the demolition of properties/structures, the diversion of public rights of way and diversion of statutory undertakers' equipment.

An advance works package has been included in the indicative programme to enable the majority of the service diversions to be carried out prior to the commencement of the cut and cover works. Services will be diverted into dedicated service crossings at various points along the length of the route. The diaphragm walling required to support the sides of the cut and cover sections of the tunnel will have to accommodate these crossings. Bridging structures will be required to support the services across cut and cover sections. These are likely to be in the form of piled ground slabs although the final detail will depend on detailed design and further consultation with statutory undertakers.