New Mersey Crossing
Report of Works 2

EXECUTIVE SUMMARY

March 2003
Introduction

Congestion on the Silver Jubilee Bridge is constraining much needed local, sub-regional and regional development. A new Mersey Crossing in Halton has been identified by the North West Regional Assembly and by the North West Development Agency as a key transport priority of regional significance. Earlier studies concluded that a new crossing is technically feasible and would provide value for money.

The Mersey Crossing Group (MCG), led by Halton Borough Council and comprising all the Merseyside local authorities, Merseytravel, Warrington Borough Council, local Chambers of Commerce, English Partnerships and Peel Holdings, is promoting a new crossing in Halton.

In July 2001 the MCG appointed Gifford & Partners as Project Manager and Lead Consultant to carry out a study to investigate the environmental concerns raised by a new crossing. The Desk Study, submitted in November 2001, identified that the potential impact on wildlife would probably be most significant during construction and would need particular care and attention. However, in the long term, the impact would be relatively minor and could be readily mitigated. The remaining concern of note remained the potential effect on the dynamics of the estuary arising from piers within the normal tidal range.

The Desk Study listed the further studies necessary to carry out the Environmental Impact Assessment (EIA) necessary to take the scheme forward. This work commenced in January 2002 starting with ecological, seismic and hydrodynamic surveys. Several boreholes and trial pits have been sunk within the study area and the sediment and water samples taken have been tested.

Assessments have been carried out of the likely social and economic impacts of a new crossing and the impact on the landscape and heritage of the Borough of alternative routes and different bridge types. The effects of traffic noise and changes in air quality have also been assessed.
The Options

A number of alternative routes for a new Mersey crossing have been considered:

The objectives of a new Mersey crossing are:

* to relieve the Silver Jubilee Bridge
* to maximise development opportunities
* to improve public transport links across the river, and
* to encourage the increased use of cycling and walking.

Consultation has shown that the public see the Silver Jubilee Bridge (SJB) as their local bridge as it is the most convenient crossing point for local traffic, cycling, walking and for bus services within the Borough. The new crossing needs to be the strategic crossing for non-local and through traffic with good links to the existing road network. The amount of relief that the new crossing provides must be sufficient to enable the provision of adequate space for public transport, cycling and walking on the old bridge. Alternatives to a new crossing such as improved rail and bus services cannot meet this objective neither would they help to maximise development opportunities.

A route to the west of the railway bridge between Weston Point and Hale Bank would have to be in tunnel under the estuary because of the very sensitive environmental nature of the area. This route fails to provide sufficient relief to the SJB and would also be a very expensive solution. This option was not considered further.
Route 1 is immediately upstream of the SJB from a modified junction with the Daresbury Expressway to Ditton Roundabout with new links to Ashley Way. This route would significantly affect West Bank and Runcorn Old Town.

Route 2 connects Astmoor Interchange to a new roundabout on Ashley Way passing west of the Rhodia Works. There would be a new link to Ditton Roundabout. Some turning movements at Astmoor Interchange would be restricted.

Route 2A connects Astmoor Interchange to a new roundabout on Widnes Eastern bypass passing east of the Rhodia works. This route would provide less relief to the SJB than Routes 2, 3 or 3A and has no advantages over these routes. This option was not considered further.

Route 3 connects the Central Expressway, from its junction with the Daresbury Expressway, to a new roundabout on the Widnes Eastern bypass, passing to the east of the Rhodia works. There would be a new link from the bypass to Ditton Roundabout.

Route 3A connects the Central Expressway, from its junction with the Daresbury Expressway directly to Ditton Roundabout passing west of the Rhodia works. There would be a new link to the Widnes Eastern bypass from a grade separated roundabout.

Route 4 commences at Manor Park junction on the Daresbury Expressway, crossing the River Mersey at Randles Sluices. The route skirts the Cuerdley Marsh and links to the Widnes Eastern bypass via the Fiddlers Ferry Road. This route was considered, following representation by a consultant who felt that it would have least effect on the estuary. This route would not provide sufficient relief to the SJB and fails to meet the objectives set for a new crossing. However, it has been considered in more detail in view of its possible environmental advantages.

The Design

A new Mersey crossing would be a two-lane dual carriageway with hard shoulders enabling widening at some time in the future to dual three-lane to allow for traffic growth. Junctions on the main line would be grade separated where possible. The bridges would provide adequate clearance for canal traffic and for current users of the Mersey estuary over at least part of its width. Sufficient clearance would also be provided for the possible electrification of the Garston to Runcorn freight line. A new bridge would not preclude its use for the possible extension of Merseyram Line 3, south of the river.
Consultations

Gifford has maintained a dialogue with the public and the main stakeholders throughout the period of the studies and the project has been widely publicised in the local and regional media. The project website has also been available to provide details and to enable direct communication and feedback. The object has been to ensure that nobody should be denied the opportunity to comment.

The views of residents, businesses, local stakeholders and the public at large have been obtained from Focus Groups, carefully selected to be representative of the Borough and users of the bridge. In addition, exhibitions and presentations of the proposals have been held and leaflets and questionnaires widely distributed.

The concerns of the main stakeholders have been in respect of the environmental impact of a new crossing. Consultation has helped to guide the nature and extent of the studies to determine the significance of potential impacts and to identify means by which they can be mitigated.

Consultation has revealed that the public including residents and businesses are overwhelmingly in favour of a new crossing. When selecting the best route the most important factors given were relieving congestion, reducing traffic flow on the current bridge and minimum disruption to local communities. Routes 3 and 3A are clearly favoured by the public from the Questionnaire response, with Routes 1 and 2 receiving very little support. Traffic flow, good road links and avoiding residential areas are stated as the main reasons for preferring these routes.

Many people responding to the Questionnaire selected Route 3 over Route 3A due to concerns about congestion at Ditton Roundabout. These concerns are unfounded and may have arisen from a lack of detail in the information available. This is borne out by the clear preference of the Focus Groups for Route 3A with the benefit of access to more detailed information.

Appraisal of the Options

The impact of the alternative routes on the environment, both human and natural, have been assessed in accordance with the requirements of current legislation governing the approval of major projects.

The assessments have been brought together in the form of an Appraisal Framework making it easier to compare the impacts of each route and ensuring that the reasons behind the eventual choice are open and transparent.
Conclusions

Assessments have clearly shown that a new crossing would bring significant economic benefit to Halton and surrounding districts including the Merseyside sub-region, also there would be a significant saving to road users and a reduction in accidents. The benefits and savings far exceed the cost of a new crossing showing that the investment provides excellent value for money.

The appraisal shows that Route 1 has the greatest negative impact on the issues to be addressed in the Environmental Impact Assessment (EIA). In particular its impact on the community and the landscape could be considered to be unacceptable. Although less expensive than Routes 2, 3 and 3A, Route 1 does not provide the best value for money when economic benefits and travel savings are taken into account and is the route least favoured by the public.

Route 4 has the least negative impact in terms of the EIA but does not meet the objectives set for a new crossing. There would seem little point in pursuing a scheme that would not achieve what it is required to accomplish, no matter what its other merits may be.

Of the remaining alternatives, there is little to choose between Routes 2, 3 and 3A in terms of the EIA provided that the number of piers in the river is limited to 2 or 3. The choice between these routes will therefore be determined by other factors.

Route 2 is not favoured by the public and performs less well in traffic terms than Routes 3 and 3A. The choice would therefore appear to be between the latter two routes, both of which received substantial public support.

Of the two, Route 3A performs best in traffic terms having a grade separated connection with the Widnes Eastern bypass and a superior link to Speke Road. Although it would cost more than Route 3, this route remains good value for money and the economic assessment shows that it has the best potential for creating employment. On balance we feel that Route 3A is the best route for a new Mersey crossing in Halton.

The Next Steps

Preliminary talks about obtaining funding for the project have taken place with the Department for Transport and a formal application is to be submitted as part of the Annual Progress Report of the Local Transport Plan in July. A decision on this application will not be given until December and in view of the cost of the project it is most unlikely to be included in the Local Transport Plan allocation for 2004. More likely is that the bid will be considered for PFI funding in a future year.

The work undertaken by Gifford to date has enabled the selection of a preferred route to be taken forward to the next stage. Discussions are currently taking place with legal advisors experienced in the promotion of major transport projects about the appropriate statutory procedures to be used to take the project forward. But, whatever statutory power is sought to progress the scheme it is likely to lead to a public inquiry into the proposals.
In preparation for the forthcoming stages it will be necessary to prepare an Environmental Statement for the preferred route and further environmental surveys and monitoring will be required over the coming months.

Given the uncertainties about funding and the almost inevitable public inquiry, it is difficult to set a firm programme for the commencement and completion of the new crossing. However, it remains our view that from a design and construction standpoint, it should be possible to commence work in the Spring of 2005 for completion before the end of 2007 or early 2008. It would not be unreasonable to expect decisions on funding and the public inquiry in the intervening 2 years before work is scheduled to start.
NEW MERSEY CROSSING

REPORT OF WORKS 2
VOLUME 1
NEW MERSEY CROSSING
REPORT OF WORKS 2
VOLUME 1
VOLUME 1

CONTROLLED DOCUMENT

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<td>Prepared by: Pedr Roberts</td>
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Revision Record

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20 Nicholas Street
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# NEW MERSEY CROSSING

## REPORT OF WORKS 2

### VOLUME 1

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VOLUME 2 – HIGHWAYS AND STRUCTURE DRAWINGS (Bound Separately)
FOREWORD

Halton Borough Council, on behalf of the Mersey Crossing Group, is currently promoting a second integrated crossing of the Mersey within the Borough, between Runcorn and Widnes. Gifford and Partners were appointed as Project Manager and Lead Consultant in July 2001 to undertake the further studies necessary to take the project forward.

A substantial body of work has been undertaken to date on the project, including design, investigation of funding options and environmental studies. The work has culminated in the production of a series of reports which are summarised in the following table:

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In addition to these main reports, the detailed technical studies have been reported in a series of Technical Reports which provide supporting details for the Report of Works, Environmental Impact Assessment and Major Scheme Appraisal. These reports are listed in the table below:
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The work undertaken to date has focused on comparing potential options for a new crossing. The next stage of the project will focus on a preferred option, chosen by the Mersey Crossing Group.

Queries regarding any of the above reports should be addressed to either of the contacts below:

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Gifford and Partners  
Report No. B4027/02
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Route 2 connects Astmoor Interchange to a new roundabout on Ashley Way passing west of the Rhodia Works. There would be a new link to Ditton Roundabout. Some turning movements at Astmoor Interchange would be restricted.

Route 2A connects Astmoor Interchange to a new roundabout on Widnes Eastern bypass passing east of the Rhodia works. This route would provide less relief to the SJB than Routes 2, 3 or 3A and has no advantages over these routes. This option was not considered further.

Route 3 connects the Central Expressway, from its junction with the Daresbury Expressway, to a new roundabout on the Widnes Eastern bypass, passing to the east of the Rhodia works. There would be a new link from the bypass to Ditton Roundabout.

Route 3A connects the Central Expressway, from its junction with the Daresbury Expressway directly to Ditton Roundabout passing west of the Rhodia works. There would be a new link to the Widnes Eastern bypass from a grade separated roundabout.

Route 4 commences at Manor Park junction on the Daresbury Expressway, crossing the River Mersey at Randles Sluices. The route skirts the Cuerdley Marsh and links to the Widnes Eastern bypass via the Fiddlers Ferry Road. This route was considered, following representation by a consultee who felt that it would have least effect on the estuary. This route would not provide sufficient relief to the SJB and fails to meet the objectives set for a new crossing. However, it has been considered in more detail in view of its possible environmental advantages.

The Design

A new Mersay crossing would be a two-lane dual carriageway with hard shoulders enabling widening at some time in the future to dual three-lane to allow for traffic growth. Junctions on the main line would be grade separated where possible. The bridges would provide adequate clearance for canal traffic and for current users of the Mersey estuary over at least part of its width. Sufficient clearance would also be provided for the possible electrification of the Garston to Timperley freight line. A new bridge would not preclude its use for the possible extension of Merseytram Line 3, south of the river.

Consultations

Gifford has maintained a dialogue with the public and the main stakeholders throughout the period of the studies and the project has been widely publicised in the local and regional media. The project website has also been available to provide details and to enable direct communication and feedback. The object has been to ensure that nobody should be denied the opportunity to comment.

The views of residents, businesses, local stakeholders and the public at large have been obtained from Focus Groups, carefully selected to be representative of the Borough and users of the bridge. In addition, exhibitions and presentations of the proposals have been held and leaflets and questionnaires widely distributed.

The concerns of the main stakeholders have been in respect of the environmental impact of a new crossing. Consultation has helped to guide the nature and extent of the studies to determine the significance of potential impacts and to identify means by which they can be mitigated.
Consultation has revealed that the public including residents and businesses are overwhelmingly in favour of a new crossing. When selecting the best route the most important factors given were relieving congestion, reducing traffic flow on the current bridge and minimum disruption to local communities. Routes 3 and 3A are clearly favoured by the public from the Questionnaire response, with Routes 1 and 2 receiving very little support. Traffic flow, good road links and avoiding residential areas are stated as the main reasons for preferring these routes.

Many people responding to the Questionnaire selected Route 3 over Route 3A due to concerns about congestion at Ditton Roundabout. These concerns are unfounded and may have arisen from a lack of detail in the information available. This is borne out by the clear preference of the Focus Groups for Route 3A with the benefit of access to more detailed information.

Appraisal of the Options

The impact of the alternative routes on the environment, both human and natural, have been assessed in accordance with the requirements of current legislation governing the approval of major projects.

The assessments have been brought together in the form of an Appraisal Framework making it easier to compare the impacts of each route and ensuring that the reasons behind the eventual choice are open and transparent.

Conclusions

Assessments have clearly shown that a new crossing would bring significant economic benefit to Halton and surrounding districts including the Merseyside sub-region, also there would be a significant saving to road users and a reduction in accidents. The benefits and savings far exceed the cost of a new crossing showing that the investment provides excellent value for money.

The appraisal shows that Route 1 has the greatest negative impact on the issues to be addressed in the Environmental Impact Assessment (EIA). In particular its impact on the community and the landscape could be considered to be unacceptable. Although less expensive than Routes 2, 3 and 3A, Route 1 does not provide the best value for money when economic benefits and travel savings are taken into account and is the route least favoured by the public.

Route 4 has the least negative impact in terms of the EIA but does not meet the objectives set for a new crossing. There would seem little point in pursuing a scheme that would not achieve what it is required to accomplish, no matter what its other merits may be.

Of the remaining alternatives, there is little to choose between Routes 2, 3 and 3A in terms of the EIA provided that the number of piers in the river is limited to 2 or 3. The choice between these routes will therefore be determined by other factors.

Route 2 is not favoured by the public and performs less well in traffic terms than Routes 3 and 3A. The choice would therefore appear to be between the latter two routes, both of which received substantial public support.
Of the two, Route 3A performs best in traffic terms having a grade separated connection with the Widnes Eastern bypass and a superior link to Speke Road. Although it would cost more than Route 3, this route remains good value for money and the economic assessment shows that it has the best potential for creating employment. On balance we feel that Route 3A is the best route for a new Mersey crossing in Halton.

The Next Steps

Preliminary talks about obtaining funding for the project have taken place with the Department for Transport and a formal application is to be submitted as part of the Annual Progress Report of the Local Transport Plan in July. A decision on this application will not be given until December and in view of the cost of the project it is most unlikely to be included in the Local Transport Plan allocation for 2004. More likely is that the bid will be considered for PFI funding in a future year.

The work undertaken by Gifford to date has enabled the selection of a preferred route to be taken forward to the next stage. Discussions are currently taking place with legal advisers experienced in the promotion of major transport projects about the appropriate statutory procedures to be used to take the project forward. But, whatever statutory power is sought to progress the scheme it is likely to lead to a public inquiry into the proposals.

In preparation for the forthcoming stages it will be necessary to prepare an Environmental Statement for the preferred route and further environmental surveys and monitoring will be required over the coming months.

Given the uncertainties about funding and the almost inevitable public inquiry, it is difficult to set a firm programme for the commencement and completion of the new crossing. However, it remains our view that from a design and construction standpoint, it should be possible to commence work in the Spring of 2005 for completion before the end of 2007 or early 2008. It would not be unreasonable to expect decisions on funding and the public inquiry in the intervening 2 years before work is scheduled to start.
1. INTRODUCTION & BACKGROUND

The Borough of Halton stands at a strategic crossing point of the Mersey estuary providing the main rail connection between Liverpool and the West Coast Main Line and the A557 road link via the Silver Jubilee Bridge. The A557 is a principal road maintained by the local Highway Authority and connects with the M66, M62 and south Liverpool. The M66 to the South of the Borough links West Cheshire and North Wales with Manchester, whilst the M62 to the north of the Borough links the majority of Merseyside to Manchester and across the Pennines to the Yorkshire conurbations. Halton, therefore, lies on a major cross roads in the North West of England.

![Map of Region](image)

**Figure 1.1 Map of Region**

The narrowing of the estuary at the Runcorn Gap has provided a convenient crossing place since Roman times. The first bridge across the Runcorn Gap was constructed in 1868 for the railway but it wasn’t until the Transporter Bridge opened in 1905 that road vehicles could cross at this point. The Transporter Bridge was a tolled crossing but the rapid increase in traffic soon exceeded its capacity and work began in 1954 on the Silver Jubilee road bridge.

The Silver Jubilee Bridge was completed in 1961 and is the only internal link between Runcorn and Widnes. The bridge is of major strategic importance to Merseyside and North Cheshire with 80% of traffic crossing the bridge making trips across the sub-region. Traffic growth of 17% over the past seven years is almost double the average growth across the country and increasing congestion will be a constraint on the economic regeneration both locally and across the sub-region. The bridge has four sub-standard lanes and average flows of 80,000 vehicles per day, exceeding their capacity and causing congestion, queuing, accidents and regular gridlock. The bridge has poor facilities for pedestrians, no safe facilities for cyclists and severely restricts the development of integrated transport strategies.
In April 1998 Halton Borough Council became a Unitary Authority taking over from Cheshire County Council as the local Highway Authority with responsibility for the Silver Jubilee Bridge.

The crossing of the Mersey is the biggest single transport issue facing Halton Borough and it is being addressed firstly by maintaining and getting the best from the Silver Jubilee Bridge and, secondly, by promoting a second integrated crossing in Halton. This strategy is central to the Borough’s five year Local Transport Plan 2001-2006 and funding has been made available by DETR to allow the strategy to be implemented.

The strategic importance of a new Mersey crossing is recognised by the formation of the Mersey Crossing Group, chaired by Halton Borough Council and comprising representatives of all the Merseyside local authorities, Merseytravel, Warrington MBC, local Chambers of Commerce, English Partnerships and Peel Holdings.

Initial studies undertaken by Oscar Faber in 1991 – 93, on behalf of the Department of Transport, showed that the Silver Jubilee Bridge was already close to capacity and that congestion would constrain traffic demand. This study looked at a wide range of options within a 3km corridor either side of the Jubilee Bridge but the Government concluded that there was insufficient nationally strategic traffic demand to justify a new trunk road crossing. It was suggested that local authorities in the area might wish to consider the feasibility of a more local crossing.

The Mersey Crossing Group was formed following this Government decision and commissioned Oscar Faber to investigate the feasibility of a new Mersey crossing in the vicinity of the Silver Jubilee Bridge. The new crossing would be aimed at relieving the Silver Jubilee Bridge and thus facilitate future development in the widest area on both banks of the river. The study concluded that a new crossing would have a significant impact on the economy of the study area and that a central route connecting Runcorn and Widnes upstream of the existing bridge would be the cheapest to construct and would perform best in traffic terms. The study also concluded that although all the routes considered would give rise to some environmental difficulties, routes west of the existing bridge would cross the Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar site and would be most unlikely to be justified.

A further study commissioned by the Mersey Crossing Group was undertaken by Mott MacDonald to give advice on certain specific aspects of a crossing based on the central option recommended in the earlier study. This study, produced in June 1999, considered the potential form of construction of the crossing and the order of magnitude of cost but was based on the assumption that a significant area of the estuary from West Bank to Widnes Warth was to be reclaimed as part of a proposed major waterfront development.

The Mersey Crossing Group continued to seek support for a new crossing at Ministerial level and, in May 1999, received advice from the Parliamentary Under Secretary of State for Transport on the way forward. Based on this advice, the Mersey Crossing Group decided to pursue a new, sustainable crossing via the Local Transport Plan process and appointed WS Atkins to study the situation in more detail in order that a robust case could be presented as part of the five year Local Transport Plan. The main conclusion of the study is that low level crossings in a 2km corridor east of the existing bridge are technically feasible and provide good value for money. An alignment from the Central Expressway in Runcorn to the East of the former Albright and Wilson works in Widnes was seen as the
best performing option but a firm preference could not be finally confirmed until further work had been carried out. The study also showed that the cost of the crossing would fall within a viable PFI range and would perform well in terms of traffic operation and economic development aims. However, it also concluded that a crossing could have potentially adverse environmental impacts on the river and estuary, the most critical being the impact on the river hydrodynamics and the potential risk of contamination from overlying materials in the riverbed and on the banks.

In July 2001 the Mersey Crossing Group appointed Gifford and Partners as Project Manager and Lead Consultant to undertake the further studies necessary to take the scheme forward.

2. EXECUTIVE SUMMARY FROM REPORT OF WORKS 1

Between August and November 2001 Gifford carried out a Desk Study, full details of which can be found in Gifford Report No B4027/01. The following summary of the Report of the Desk Study is included below as a reminder of the findings and recommendations from the desk study.

2.1 Introduction

Building on draft Regional Planning Guidance, and in response to the Government’s ten-year transport plan, the North West Regional Assembly (NWRA) and the North West Development Agency (NWDA) have identified the new Mersey Crossing as a key transport priority of regional significance, to be implemented by 2010. The proposal is endorsed in the Merseyside Local Transport Plan, where the existing bridge is recognised as a key constraint point within the Merseybelt highway network. This is of particular significance in the Merseyside Freight Strategy. A new crossing is supported by a partnership of Halton Borough Council, all the Merseyside local authorities, Merseytravel, Warrington Borough Council, local Chambers of Commerce, English Partnerships and Peel Holdings.

The congestion on the Silver Jubilee Bridge is constraining much needed local, sub-regional and regional development and is the biggest single transport issue facing Halton Borough. It is being addressed firstly, by maintaining and getting the best from the Silver Jubilee Bridge and secondly, by promoting a new crossing in Halton. A new Mersey Crossing is a policy objective in Halton Borough’s Local Plan and its strategy is central to the Borough’s five year Local Transport Plan 2001-2006. Funding has been made available by DTLR to assist the strategy to be implemented.

Earlier studies concluded that a new crossing would have a significant beneficial impact on the economy of the area and that crossings in a 2km corridor east of the existing bridge perform best in traffic terms, are technically feasible and provide good value for money. However, the studies also concluded that a crossing could have potentially adverse environmental impacts on the river and estuary. The most critical being the impact on the hydrodynamic processes in the river and the potential risk of mobilising contaminants from overlying materials in the riverbed and on the banks.

In July 2001, the Mersey Crossing Group appointed Gifford and Partners as Project Manager and Lead Consultant. Gifford’s team includes local ecological advisors –
APEM Limited and Environmental Research & Advisory Partnership, and it is the
team's task to gather all the existing information about the site - its ecology, the
hydrodynamics of the estuary, the ground conditions and the history of contamination
in the area. This requires extensive research and consultation with various statutory,
commercial and voluntary bodies. As a result of work to date, Gifford have been able
to make a preliminary engineering assessment of the founding situs, an appraisal of
the environmental risks and liabilities, and have set out any further investigations that
are thought to be necessary.

2.2 Alternative Routes and Bridge Options

The main objectives of a new Mersey crossing are:

1. To relieve the Silver Jubilee Bridge, thereby removing the constraint on local and
regional development and better provide for local traffic needs.

2. To maximise development opportunities on the riverfront and in Halton.

3. To improve public transport links across the river.

4. To encourage the increased use of cycling and walking.

A number of routes have been considered in earlier studies. These were narrowed down to
three within the current study area - the most favoured being a route from the Central
Expressway to east of the former Albright & Wilson works (now Rhodia). This route was
recommended as it would provide the best potential for development and regeneration and
would be best located to provide for local transport links. Gifford concur with this view and
have used this route as the focus for this study. In order to reach meaningful conclusions,
it is helpful to have some preliminary thoughts on potential bridging solutions.

A new bridge must fulfil three aims to be successful:

1. It must fulfil its function
2. It must fit its environment, and
3. It must be economic

Gifford have looked at four bridge arrangements which could be suited to the favoured
crossing location with these precepts in mind. At the preferred location, the normal tidal
limit of the estuary is approximately 900 metres wide. Although the adjacent salt marshes
can be covered by the very highest tides, piers in these areas would have little effect on the
behaviour of the river (although there may be some localised impact on the ecology). It is
piers within the normal tidal limits that are of most concern since these will have the
greatest influence on the hydrodynamic processes that are so important to the character
and form of the estuary.

The options considered range from probably the most economical (having many relatively
short spans and many piers in the estuary) to probably the most expensive (having a single
long span and no piers in the normal tidal limits of the estuary). None of the four options
would restrict navigation on the Manchester Ship Canal.
2.3 Preliminary Findings from the Study

2.3.1 Ecology

The Study Area contains sites and habitats of international, national and local nature conservation importance which include designated and non-statutory wildlife sites. There are also protected species present, populations of birds of substantive nature conservation importance and both national and local Biodiversity Action Plan species. There are also large areas of inter-tidal and sub-tidal habitat which are important for wildfowl and waders.

Construction of the new Mersey crossing will directly affect the Upper Mersey Estuary - a Grade A Site of Biological Importance (SBI). This consists primarily of the Astmoor Saltmarsh and Swamp and Widnes Warth. These are typically salt tolerant, ungrazed grasslands providing a habitat to a wide variety of estuarine birds. There may also be adverse direct and indirect effects on several Sites of Importance for Nature Conservation (SINCs). These areas will suffer some loss of salt marsh, inter-tidal and sub-tidal habitat and their ecological components due to construction and disturbance. There could also be impact from hydraulic changes to the estuary flow, which could increase remobilisation of contaminated sediments. Further downstream, below the Runcorn Gap, there is the possibility of indirect impacts on the Mersey Estuary Special Protection Area (SPA), Ramsar site and Site of Special Scientific Interest (SSSI) located downstream of the Runcorn Gap. These areas provide an important habitat for estuarine invertebrates, fish and large numbers of waterfowl including protected species.

The most significant and substantive impact will be during the construction stage. Further detailed surveys are necessary to assess the full importance of the salt marsh, inter-tidal and sub-tidal habitats, the impacts of construction on biodiversity and to the recovery status of the Mersey Estuary. Once the new crossing is open to traffic, impacts will be relatively minor.

Substantial mitigation will be necessary to protect and sustain the habitats during and after construction, and to prevent adverse effects on nearby sites of nature conservation importance.

At this stage in the study, it is felt that effective mitigation of the impacts of the scheme on biodiversity during and after construction is feasible.

2.3.2 Hydrodynamics

The upper estuary is characterised by a highly mobile and active bed. It is understood, for example, that sand banks can move position rapidly, even within a few days. This natural dynamic process must be retained.

Gifford's research of the currently available data suggests that, within this natural process, there is persistence of two main channels within the tidal river - one to the north of the estuary and the other to the south. From the period between 1967 and 1997, it was observed that sedimentation occurred within the channels and these are sitting up with time although the general channel profile remained fairly constant. It was found that the approximate depth of movement of the silt within the estuary was in the order of 1.5 metres. Below this depth the material appears to be more stable.
From discussions with many interested parties, it is clear that the prevailing view is that a new bridge must not cause a permanent shift in the position of these channels nor cause any fundamental change to the overall mobility of the bed of the estuary. It is also important that the bridge, either during its construction or in operation, does not increase the risk of erosion to the salt marsh edge or the established banks of the estuary.

The conclusion may be drawn that there is benefit from reducing the number of bridge piers that need to be constructed within the tidal river and that construction in either of the main channels should be avoided. Both of these criteria can be achieved with the forms of bridge under consideration although the "short-span" option does present very practical difficulties in this regard.

Records of the estuary suggest that the impact of fluvial flood events does not significantly affect the overall processes involved in bed movement. Tidal influence is far greater and needs to be better understood. It is proposed to install a tide gauge within the Upper Estuary for the design period and carry out current surveys throughout the tidal cycle for this purpose.

Gifford intend to commission the development of an established mathematical model of the estuary to assist in the development of the design. This modelling will be used to establish the range of impacts on the hydrodynamic processes that might occur as a consequence of different configurations of bridge piers and their alignment to the channel. Specific modelling, possibly including the use of a physical model, will be used to investigate localised scouring at bridge piers and to assist in developing sound engineering solutions to this potentially significant problem.

2.3.3 Geology and Contamination

Bedrock is shallow on the Runcorn (south) side of the river, being generally less than 10 metres deep, but deepens northwards across the Mersey to over 40 metres deep southeast of Widnes. Actual depths beneath the estuary itself are uncertain at this stage. On the north side, it is likely that the overlying glacial soils could support the pier foundations. On the south side the piers would have to be either piled to the underlying rock or constructed directly onto the sandstone.

Further detailed geotechnical investigations will be required to determine the rock-head profile and the strength of founding materials.

The study area contains numerous sites which are potentially contaminated as a result of historical and current land use. Previous site investigations in the area have confirmed that made ground in the southeast Widnes area and on Wigg Island is generally contaminated with a range of potentially hazardous substances, including widespread contamination from heavy metals and sulphur compounds. In addition, sediments beneath the salt marshes and in the Mersey Estuary are contaminated as a result of surface water run-off from contaminated land and industrial sewage discharges.

The construction of the new Mersey crossing will involve the excavation and disturbance of some of these contaminated materials for the construction of foundations. This could result in the release of contaminants into the ground and surface water systems with consequential impacts on ecology and water quality. The contamination within the overlying soils on both sides of the river has the potential to contaminate the underlying
water-bearing rocks. The north side benefits from a significant depth of the relatively impermeable overlying soils and the Environment Agency reports little evidence of groundwater contamination in this area. On the south side, however, the water bearing rocks are close to (and, in some instances, at) the surface and there is a significant potential for contamination of the groundwater. Particular care will be required during the construction of the works to ensure that contamination is not released and special techniques will have to be employed. Enquiries with specialist contractors have shown that there are several examples of such techniques having been successfully used on "brownfield" sites where similar contamination risks have been present.

A risk assessment will be required to quantify potential impacts and determine the extent of mitigation required. Further investigation of the location, extent and nature of the contamination will be needed to provide sufficient information to carry out the risk assessment and devise appropriate mitigation measures that can be put in place, either to eliminate identified risks or reduce them to an acceptable level.

2.4 Conclusions

The desk study has shown that the proposal for a new Mersey crossing in Halton will raise environmental concerns. The potential impact on wildlife is most significant during construction and will need particular care and attention. In the long-term, the impact will be relatively minor and could be readily mitigated. Similarly for water quality - although in this case the long-term impact will be almost negligible. The remaining concern of note is the potential effect on the dynamics of the estuary arising from piers within the normal tidal range. It is Gifford's opinion that a medium span bridge with just three piers in the estuary will be economically feasible and have minimal adverse impact on the environment.

2.5 The Way Forward

During the next stage, more detailed investigations must be undertaken in order that a full and proper Environmental Impact Assessment can be carried out. This must also include an appraisal of the impacts of the favoured route compared with any reasonable alternative that may be available or be proposed.

Early in the New Year, a detailed ground investigation will commence. Whilst this is underway, there will be further ecological surveys to ensure that conditions in Spring and Summer are covered and traffic and accident data will be updated. There will be ongoing consultations with all the relevant environmental bodies and other organisations to establish the scope of the environmental investigations and to determine the extent of the mitigating measures that will be required.

Over the coming months, it will be essential to engage the public at large - inviting views and comments and engendering a better understanding of the issues through dialogue and discussion. The Mersey Crossing website (which is to be launched shortly) will play a vital role in this process.

There will be extensive consultation with the statutory bodies and interested parties as part of the development of the scheme with the expectation of being in a position to submit a planning application and publish any necessary Orders in Autumn 2003. There will then follow a period of statutory consultation, after which the application will probably be referred to the Secretary of State. It is almost certain, with a scheme of this size and importance,
that a Public Inquiry will be held to examine the proposals. This inevitably results in uncertainty in predicting a possible start date for the scheme. A delay of about a year can be expected at this stage of the project. Subject to the delay being no longer than this, work could start on site in 2004 and be completed in 2007.

The cost of construction of the new Mersey crossing is estimated to be in the range of £150million to £240million depending largely on the type of bridge constructed. In our view, the medium span bridge has the most to commend it, being both aesthetically pleasing and having a reduced impact on the dynamics of the estuary compared to the multi-span option. This option is estimated to cost £155million.

Although the government has provided some funding for the development of the scheme, funding of this magnitude is unlikely to be made available in the foreseeable future given the demands on government expenditure. A more likely source of funding is to be found through some form of private finance initiative. There are a number of successful examples of this form of funding in recent years, notably the Dartford crossing in East London, the new Severn crossing between England and Wales and the Skye Bridge in Scotland. At this stage, it would be prudent to pursue all possible funding possibilities.

3. DEVELOPMENT OF THE BRIEF

The object of the original brief was to carry out a preliminary sources survey (Desk Study) from which it could be estimated the extent to which ground conditions and environmental concerns presented a risk to the project going forward. The requirements of this brief were:

- To gather all information relating to the site including the hydraulic regime of the estuary, ground conditions, the site history and any information that can be gleaned from a walk-over survey.

- To establish a conceptual ground model from which methods for founding the structure and mitigating the environmental risks can be conceived.

- To consult with relevant bodies.

- To prepare a report summarising the information obtained in order to make a preliminary engineering assessment of the founding strata likely to be present, the likely foundation for any structure, and a brief appraisal of the environmental risks or liabilities associated with the site.

- To set out any further investigations that are thought to be necessary.

The findings of the Desk Study largely determined the brief for the present stage of the project. However, consultations carried out as part of the Desk Study confirmed that the project would almost certainly require an Environmental Impact Assessment (EIA). An important element of the EIA is to assess and compare the environmental impacts of alternative routes together with an appraisal of their relative economic and social benefits. Further consultation on the EIA Scoping Report resulted in a widening of the study area to include routes and alternatives not previously considered.
Preliminary discussions with the Department for Transport on funding options identified the need to carry out a Major Scheme Appraisal (MSA) to be included with an application for Government funding through the Local Transport Plan process.

4. FURTHER INVESTIGATIONS

4.1 Introduction

The further investigations and studies carried out between November 2001 and February 2003 are summarised briefly in this section. Most of the investigations were identified in Report of Works 1 but some additional work was identified as a result of the change in the brief discussed in Section 3.

4.2 Ground Investigations

A summary of the ground investigations carried out since January 2002 is presented below. Details of the ground conditions encountered and geotechnical parameters derived for use in the foundation design and geotechnical aspects of a proposed crossing are given in Technical Report No TR15/01, Geotechnical Interpretative Report.

Details of the local and regional ground conditions, hydrogeology, contamination and groundwater quality are given in Technical Report No TR04/01, Soils, Geology, Groundwater and Contamination.

4.2.1 Background to Ground Investigation

The ground investigation was intended to provide information relating to the overall study area but to also include specific information along the lines of the various route options. Following the Desk Study and review of available information the intrusive investigation focused primarily on the route corridors of Routes 2 and 3.

Route 1 is located alongside the existing Jubilee Bridge crossing between Runcorn and Widnes, and at this stage in the project it was considered that the objectives of the investigation were already met. There is information available relating to the construction of the bridge and subsequent carriageway upgrades, such as the A568 Widnes Eastern Bypass Extension. Rock outcrops are visible close to the existing crossing providing confirmation of the rock levels within the likely location of bridge piers and abutments. Further desk study information is also available on the approach routes to the existing bridge and for a number of properties in the area covered by these routes.

The ground investigation combined conventional intrusive methods with geophysical (non intrusive) investigation methods. The objective of the investigation works were to provide information on the following areas:

- Areas remote from the River comprising the urban/industrial areas of Runcorn and Widnes
- The salt marshes forming the banks of the River
- Runcorn Sands inter-tidal sand banks
The investigation was carried out in accordance with current standards including the following:

- BS5930 (1999) Code of Practice for Site Investigations
- BS10175 (2001) Investigation of Potentially Contaminated Sites
- BS1377 (1990) Soils Testing for Civil Engineering Purposes

Laboratories with UKAS and/or NAMAS accreditation carried out all analytical work (chemical analysis and geotechnical laboratory testing). Where UKAS accreditation does not apply to specific tests this is detailed in the relevant results.

The ground investigations were intended to provide sufficient information to allow a comparison of the routes to be undertaken in geotechnical, environmental and engineering terms. Further investigation of a selected route will ultimately be required to allow the detailed design to be finalised.

The approach to the investigation work was in accordance with BS5930 (1999) Code of Practice for Site Investigation, BS10175 (2001) Code of Practice for the Investigation of Potentially Contaminated Sites and other relevant guidance. The work was undertaken with reasonable skill, care and diligence.

The primary objective of the geo-environmental investigation for the proposed New Mersey Crossing was to characterise the following in the study area:

- Nature and distribution of ground conditions, both solid and drift geology
- Geotechnical parameters of Soil/Rock strata
- Groundwater and Hydrogeology
- Ground contamination
- Groundwater quality

4.2.2 Ground Investigation Methodology

When the intrusive investigation and geophysical surveys were designed it was acknowledged that the route options were liable to change as specific information such as traffic figures, ecology, population studies etc. became available. Consequently the investigation was not centred exactly on the route alignment.

The methodology adopted for both the geophysical and intrusive investigations was to undertake the work in a series of stages, which allowed for a review of data between each successive phase.

The stages of the investigation works can be summarised as follows:

a) Geophysical Investigation

Gifford appointed Reynolds Geo-Sciences Ltd (RGSL) as geophysical consultants for the project. The objective of the seismic surveys was to determine the depth to bedrock across the estuary for subsequent foundation solutions.
The geophysical investigation was subdivided into three phases as follows:

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<th>Phase</th>
<th>Objective</th>
<th>Contractor</th>
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| 1     | Salt Marsh Geophysical Investigation  
To determine the depth and structure of bedrock beneath the areas of salt marsh on the banks of the Mersey Estuary | TerraDat UK Ltd  
March 2002 |
| 2     | South Channel Geophysical Investigation  
To determine the depth and structure of bedrock in the main southern channel of the Mersey, between the key crossing points | Clydeside Surveys Ltd  
August 2002 |
| 3     | Runcorn Sands Geophysical Investigation  
To determine the depth to bedrock on the proposed crossing routes over Runcorn Sands. | TerraDat UK Ltd  
July/August 2002 |

Three techniques of geophysical surveying were used during the investigation, as follows:

- Land Based Seismic Refraction Survey (Phases 1 & 3)
- Land Based Seismic Reflection Survey (Phases 1 & 3)
- Marine Boomer Survey (Phase 2)

The data, results and interpretation of the geophysical surveys are presented in Reynolds Geosciences Ltd. Report Reference J0111.100.

b) Intrusive Ground Investigation

The intrusive investigations followed the Phase 1 geophysical survey. Subsequent geophysical surveys overlapped with the intrusive geotechnical work. The intrusive investigations were intended to provide information on the nature and distribution of ground conditions within the study area and to provide samples for geotechnical testing and contamination analysis.

Deep intrusive investigations were carried out in the industrial areas and salt marshes, but not within the Mersey estuary. Boreholes were formed as close as possible to the edges of the salt marsh to allow for correlation with the geophysical data. Shallow intrusive investigations were carried out on Runcorn Sands in combination with geophysical survey work.

The intrusive ground investigation comprised the following:

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<th>Phase</th>
<th>Objective</th>
<th>Contractor</th>
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| 1     | Urban Intrusive Investigation  
To determine the ground and groundwater conditions underlying the in the areas north of St Helens Canal and south of Wigg Island. | Norwest Holst Soil Engineering Ltd  
April/June 2002 |
| 2     | Salt Marsh Intrusive Investigation  
To determine the ground and groundwater conditions underlying the salt marshes north and south of the River. | Norwest Holst Soil Engineering Ltd  
August/September 2002 |
| 3     | Runcorn Sands Intrusive Investigation  
To determine the ground and groundwater conditions at shallow depth within the inter-tidal area of the River. | Geotechnics Ltd  
November 2002  
September/November 2002 |
The following techniques were employed in the intrusive investigations:

- Light Cable Percussion Boreholes
- Rotary Cored Borsholes
- Machine excavated Trial Pits & Trial Trenches
- Installation of groundwater and gas monitoring wells

4.3 Topographical Surveys

Topographical surveys were carried out during the summer of 2002 to provide information for the design of junctions. The extent of these surveys can be seen on Drawing No. B4027/H/R/002.

4.4 Traffic Modelling

Details of the traffic modelling carried out are given in Technical Report No TR09/01, Transport Impact Assessment.

4.5 Environmental Impact Assessment

The following investigations and studies were carried out to enable an environmental impact assessment of route alternatives to be undertaken. A summary of the assessments carried out to date is given in section 17 of this report and the full details are available in Technical Reports Nos TR01/01 to TR13/01.

- Ecological Surveys – Terrestrial, Tidal and Intertidal
- Water Quality and Sediments
- Hydrodynamic Modelling
- Cultural Heritage
- Noise and Air Quality
- Economic Assessment
- Social Impact Assessment
- Landscape and Visual Amenity
- Transport Assessment

5. PLANNING FACTORS

An assessment of the scheme against National and Regional planning objectives has been made and is detailed in the Major Scheme Appraisal Report No B4027/MSA/01.

6. SCHEME OBJECTIVES

6.1 Mersey Crossing Group Objectives

In response to a number of problems identified within Halton and the Region outlined in the Major Scheme Appraisal Report No B4027/MSA/01, Halton Borough Council and the Mersey Crossing Group have defined the objectives that they expect a New Mersey Crossing to fulfil.
The main objectives of a New Mersey Crossing are:

- To relieve the Silver Jubilee Bridge, thereby removing the constraint on local and regional development and better provide for local traffic needs. (The crossing must provide a viable alternative route to the Silver Jubilee Bridge).
- To maximise development opportunities.
- To improve public transport links across the river.
- To encourage the increased use of cycling and walking.

In addition, for the new crossing to be successful:

- It must fulfil each of the above objectives.
- It must fit its environment
- It must be economically viable

The success of the scheme will be measured by the benefits it brings to users of the crossing and to the wider community.

6.1.1 Improvement of Non-Car Borne Travel

It is a key objective of the project that the New Mersey Crossing improves public transport links across the river, and encourages the increased use of cycling and walking.

Forecast demand for traffic crossing the Mersey between Runcorn and Widnes is 114,000 AADT by 2022. Government guidelines require that provision must also be made for public transport plus cycling and walking. For those alternative modes of transport to be meaningful, this requires an attractive provision. In the case of public transport, the provision must permit the establishment of a reliable and efficient service. In the case of walking and cycling, the provision must be convenient and offer user safety. This implies physical access from the centres of Runcorn and Widnes at acceptable distances.

The most attractive corridor for cycling and walking is the route of the Silver Jubilee Bridge. Historically, the centres of leisure, employment and retail have evolved around this route as the primary route for travel.

Consequently, in order to achieve this objective, it will be necessary to provide enhanced public transport, walking and cycling facilities on the Silver Jubilee Bridge. The existing road network and current facilities for these road users, together with the length of any other route means that the number of walking and cycling journeys across any new route would be negligible.

The two crossings should be viewed as a single transport corridor. On the existing bridge, provision would be made for two lanes of local traffic, and the remaining roadspace would be devoted to pedestrians and cycles.
Strategic traffic, identified as a problem in Halton, would be encouraged through the design of the approaches onto the new crossing. Strategic cross-borough traffic would need to leave the expressway system, pass onto the SJB, and re-enter the strategic road system through a series of tortuous junctions. There would be no time saved by choosing the Silver Jubilee Bridge.

The resulting spare capacity on the Silver Jubilee Bridge would enable buses to be included within the normal carriageways. Segregated bus lanes would not be required as there would be improved reliability resulting from lower traffic flows.

It is therefore an essential requirement of the new crossing, that it transfers enough strategic traffic from the SJB to allow it to be reduced to two lanes of vehicular traffic.

A suggested typical cross section for these facilities on the SJB is shown in Figure 6.1 below:

![Reallocation of Road Space on Silver Jubilee Bridge](image)

Figure 6.1 Typical post construction section of the Silver Jubilee Bridge

This concept has evolved over the development of this project – originally, it was thought that the new bridge would carry local traffic and that the SJB would be in place to carry regional traffic.

7. CONSULTATIONS

An important component of the Environmental Impact Assessment (EIA) and Scheme Appraisal is to consult with relevant stakeholders including local residents, businesses, travellers, regional partners, local authorities, transport providers and user groups, environmental interest and Statutory Bodies. Effective consultation will ensure a scheme is developed which is widely acceptable. Specifically, it will directly inform assessments of the social, transport and economic impacts of the different bridge options as part of the EIA. Once a preferred option for the crossing is selected, consultation will enable stakeholders to participate in the design process.
Details of the consultations carried out to date are given in Technical Report No B4027/TR16/01.

8. SCHEME ALTERNATIVES

8.1 Introduction

In order to meet the scheme objectives set out in Section 6 a number of different alternatives have been considered and these are described in this section.

As part of the Environmental Impact Assessment it is necessary to consider the "do-nothing" scenario as this provides the baseline by which alternative schemes can be measured. So, what if we do nothing?

- Increasing traffic and more frequent disruptions as a result of accidents and maintenance works will lead to worsening congestion severely affecting travellers, public transport and the operation of the emergency services.

- Noise and pollution in the area of the bridge and its approaches will continue to deteriorate.

- There will be no opportunity for improving public transport or encouraging cycling and walking.

- Worsening congestion will discourage inward investment and endanger economic regeneration in Halton and the wider sub-region.

- Worsening congestion could hinder the strengthening of community services and social networks in deprived areas of Halton.

The "do-nothing" scenario is therefore not considered to be a viable alternative for the scheme in this case and is not detailed further in this section.

8.2 Alternatives to a New Crossing

No detailed studies of alternatives have been carried out. However a preliminary appraisal of the feasibility of park and ride schemes, improvements to rail infrastructure, light rail, high occupancy vehicles and improvements to bus services has been carried out and is detailed in the Major Scheme Appraisal Report No B4027/MSA/01.

These appraisals have shown that the impact of even an high level of investment and an impractically ambitious programme of improvement to the existing public transport systems would have only very small impacts on traffic levels and congestion on the SJB.
| Park & Ride | Minimal | (Unquantified) | Unlikely to have high take-up |
| Rail | 13,000 | 14% | Unrealistically optimistic scenario |
| Light Rail | 7,200 | 8% | Modal shift mainly from other public transport |
| HOV Lanes | 13,000 | 14% | Based on Leeds CC scheme |
| Buses | 6,000 | 6% | Total number of journeys – no allowance made for existing journeys by bus |

**Table 8.1 Summary of alternative measures**

Whilst the cumulative effect of these improvements may seem good, it should be recognised that the overall effect will be significantly less. It would be dangerous to double-count the traffic shift, for example, some journeys identified as being suitable for transfer to rail might well be also suitable for travel by bus.

Consequently, it is unlikely that any of these measures, taken individually or together, would provide any significant reductions in car journeys across the SJB. Any reductions that were achieved would be negated by background growth in traffic over a few years.

### 8.3 Bridge to West of the Railway Bridge

Western Routes have been considered in previous studies but would pass through the SSSI and Ramsar sites presenting serious environmental difficulties, they would give little or no benefit to the development and re-generation of Halton and do not lend themselves to the provision of alternative means of transport to meet local needs. Western routes have therefore been dismissed as possible alternatives.

### 8.4 Bridge Between Silver Jubilee Bridge and Railway Bridge

An option proposing a crossing between the Silver Jubilee Bridge and the Railway Bridge was considered and discarded for the following reasons:

- Insufficient width for new crossing: The available width, at a pinch point between the existing bridges is 21.048m, allowing for 3 metres of clearance on each side between bridges; however, the width required for a new crossing would need to be 24.25m, 2 no. 7.3m dual carriageways with 3.7m wide hardshoulder and 2.25m central reservation;

- Insufficient room for an in-line bridge pier: a new bridge pier, in-line with the existing piers, will need to be provided to prevent possible undermining of the existing piers and to maintain the existing minimum river constriction at the Runcorn Gap. The available space, between the existing piers, is lacking at this location;

- The existing Silver Jubilee Bridge approach viaducts in Runcorn and Widnes will need to be demolished and new approach viaducts constructed to accommodate the
approaches to the new crossing and the realigned approaches to the Silver Jubilee Bridge. This will cause severe traffic disruption.

8.5 Route 1 – Bridge Immediately Upstream of Silver Jubilee Bridge

8.5.1 Route Description

Route 1 is from the junction of the existing crossing with the Weston Point Expressway on the south bank, crossing Runcorn Gap along the east side of the Silver Jubilee Bridge and rejoining the existing highway at West Bank on the north bank. It is the shortest possible crossing in the study area. The proposed structure would be on the east side of the existing bridge.

8.5.2 Bridge Options

Proposed bridges at this point will be alongside the existing Silver Jubilee Bridge and should be of a form to complement it. A number of options are considered:

i. Suspension

ii. hybrid cable stayed/suspension

iii. cable stayed with harped back spans

iv. cable stayed with fanned back spans

v. steel arch

vi. balanced cantilever/steel box girder

vii. continuous viaduct
Different layouts have also been considered for the main span as follows:

i. long span with supports near the existing arch bridge piers (see Figure 8.1)

- main span approximately 330m to 385m

![Suspension Diagram]

- Hybrid Cable Stayed Suspension

![Cable Stayed with Hipped Back Span Diagram]

- Cable Stayed with Hipped Back Span

![Cable Stayed with Fanned Back Span Diagram]

- Cable Stayed with Fanned Back Span

![Arch Diagram]

- Arch

*Figure 8.1 Long Span Structures With Supports Near Arch Springings*
ii. long span with supports at the edge of each bank (see Figure 8.2)

- main span approximately 480m

a) Suspension

b) Hybrid Cable Stayed-Suspension

c) Cable Stayed with Harped Back Span

d) Cable Stayed with Fanned Back Span

e) Arch

*Figure 8.2 Long Span Structures With Supports on River Banks*
iii. A long span with supports set back an equal distance from the existing piers with one pier on the main bank and the other at a position symmetric to the arch (see Figure 8.3)

- main span of 550m

\begin{itemize}
  \item \textit{a) Suspension}
  \item \textit{b) Hybrid Cable Stayed Suspension}
  \item \textit{c) Cable Stayed with Horrned Back Span}
  \item \textit{d) Cable Stayed with Funneled Back Span}
  \item \textit{e) Arch}
\end{itemize}

\textbf{Figure 8.3 Long Span Structure Symmetric with Silver Jubilee Bridge}
iv. Balanced cantilever/steel girder (see Figure 8.4)

- single span across the river channel of approximately 330m
- two main spans of approximately 170m-200m
- multiple spans of approximately 100m-120m

**Figure 8.4 Balanced Cantilever/Girder Options**

8.5.3 Constraints

There are several constraints to any proposed road alignment along this route:

Manchester Ship Canal:
- navigation clearance
- width

River Mersey:
- navigation clearance
- width of navigable channel
- pier positions
Liverpool Airport:
- height of towers/structure

Silver Jubilee Bridge:
- proximity
- location of piers for existing structures
- approach road vertical alignment
- approach road horizontal alignment

Other Structures (South Bank):
- Welsh Chapel
- All Saints Church
- All Saints Primary School (at edge of affected zone)
- Halton College
- South Bank Hotel
- Waterloo public house
- other public house
- hall
- library
- surgery
- local businesses
- terraced houses
- landing of transporter bridge (Grade II listed)

Other Structures (North Bank):
- West Bank Primary School
- Mersey Hotel
- public house
- bowling green
- surgery
- local businesses
- terraced houses
- landing of transporter bridge (Grade II listed)

8.5.4 Review of Route

The proximity of the Silver Jubilee Bridge places restrictions on the available working space for construction and also on the road alignment. A new structure between the Silver Jubilee Bridge and the railway bridge was ruled out because there is insufficient space between the two structures to achieve the required carriageway width (see Section 9.4).

To the east of the Silver Jubilee Bridge there is less restriction on the width of the carriageway but there are restrictions on the horizontal and vertical alignment to achieve the tie ins with the existing approach roads. On the south side of the river at Runcorn, the new road has to join onto the Western Point Expressway. This is quite close to the river at
this point, requiring the new road to curve almost as soon as it has crossed the river. This need to curve the road curtails the length of structure that can be used at this point, effectively ruling out the use of the symmetric land pier structures shown in Figure 8.3. The only way to provide sufficient straight length of structure beyond the river to allow the longer spans would be to have the new structure at an angle to the existing structure. Unfortunately, this would also require the demolition of much more of the housing in Runcorn.

On the north side of the river in West Bank, the restrictions on the road alignment are fewer. The existing highway curves away westwards towards Liverpool, allowing a longer straight length of structure. The main consideration here is to limit the extent of demolition required. For this reason, the route needs to curve back onto the main alignment as soon as possible.

8.5.5 Review of Structural Types

a) Suspension

Suspension bridges have historically been the preferred solution for long span structures. The main load carrying member is the suspension cable that is draped over towers and anchored at each end into the ground. The shape of the cable is dictated by its tension resulting from its self weight and that of the load it is carrying. Without a deck structure, isolated loads would require changes in overall geometry for stability. The deck must therefore provide overall stiffness as well as serving as a distributor of load. Suspension bridges are relatively difficult to build and are expensive. Their use is nowadays tends to be restricted to only the very long span structures – in excess of 1000 metres. Such a solution is a possible (but unlikely) option in this circumstance.

Figures 8.1 to 8.3 show elevations of this type of structure against the background of the Silver Jubilee Bridge for the three different span options. Generally, the sag of the cable with vertical hangers appears to oppose the existing arch rather than complement it.

330m span: The tower heights required are lower than the top point of the arch. This type of structure looks inappropriate in this case.

480m span: Tower heights are still lower than the existing arch and the effective offset of the centre of the bridge makes it look out of place.

550m span: This longer span looks more realistic for this type of structure although constraints with the available back span length on the south side make it unlikely to be viable.

b) Cable Stayed

As with a suspension bridge, a cable-stayed bridge is a tension structure. However, the stiffness of a cable-stayed structure is provided by the relative geometry of the cable, the deck and the supporting tower. The deck acts as a strut opposing the horizontal component of the force in the cable generated by the applied load. A cable-stayed bridge is thus inherently stiff and relatively simple to build. They have become a preferred option for bridging spans in excess of 200 metres or so and their application is being advanced to spans of 1000 metres (and possibly more). Their disadvantage is that, in order to provide
the necessary economy by limiting cable loads (and hence quantity), their towers are very much taller than the equivalent suspension bridge. A cable-stayed structure is well suited to the spans required in this case. The main span would have a fanned array of cables, whereas the back spans could be either fanned or harped (parallel cables).

Figures 6.1 to 8.3 show elevations of this type of structure against the background of the Silver Jubilee Bridge for each of the three span options. The higher towers required for a cable-stayed structure tend to dominate the existing arch, particularly for the longer spans, however the diagonal cables used for this type of construction do not appear to oppose the existing arch.

330m span: Harped back spans are usually used where the back span is on land and the cables can be anchored either into an abutment or tension piers. In this case they need to span the ship canal and lead to a large open gap behind the towers that does not look appropriate. Fanned back spans are considered more suitable in this case. The tower height does not look too severe against the existing arch.

480m span: Harped or fanned cables in the back spans are possible as the back spans are entirely over land. The harped arrangement still leaves a large gap behind the towers and may lead to difficulties in the deck design. The asymmetric nature of the structure compared to the existing arch is partially masked by the angle of the cables, although it is still apparent. The higher towers tend to dominate the arch.

550m span: Harped or fanned cables can be used although the comments for the 480m span are also appropriate here. The towers, at roughly double the height, dwarf the arch. There would also be difficulties fitting the necessary back.

c) Hybrid Cable Stayed/Suspension

In order to overcome the problem of tower height and deck stiffness for the longer span bridges (1000 metres plus), a mixture of cable stays closer to the tower with a central suspended deck has been suggested. Such a hybrid structure offers the potential of greater overall economy. Examples of such a form are limited and there are no modern examples to offer. Again, for the spans under consideration here this type of structure is unlikely to be economic. Figures 8.1 to 8.3 show elevations of this type of structure against the background of the Silver Jubilee Bridge for the three different span options. Generally, the sag of the cable mixed with the diagonal lines of the stays is reasonably complementary against the background of the existing arch.

d) Steel Arch

A steel arch could be constructed from two arches braced together at high level. A modern design would look to avoiding the maintenance problem associated with the existing arch bridge caused by the extent of painting required and the number of birds nesting on the structure. The new arches would be of solid box type construction rather than the truss construction. Detail design would be dictated by buildability issues rather than in-service conditions.
The longer span arches (Figures 8.2 and 8.3) would be amongst the largest spans in the world but the restrictions on the horizontal alignment of the approach roads would make these structures difficult if not impossible to build at this location and with the dock at the level required. The shorter span shown in Figure 8.1, following the line of the centre of the trussed arch would still have a span of approximately 385m, ranking it in the top five of the bridge spans of this type in the world.

Where the use of centring is not possible, arches of this form are normally constructed by cantilever method, with the partially constructed arch being stayed back to a temporary tower at the springing. Segments of the arch would be lifted into place, gradually constructing it in two halves until they eventually met at the crown. For a box type arch, sections would need to be quite large and heavy. They would have to be positioned on a barge beneath the working face of the arch and lifted into place. Considering the proximity of the Silver Jubilee Bridge and the swift tidal flows through Runcomb Gap this would be a high risk operation. The alternative would be to erect the arch using smaller sections lifted up from the bank to form a truss type structure similar to the existing arch with the same maintenance liability.

e) Balanced Cantilever/Steel Box Girder

A single span balanced cantilever structure in either steel or prestressed concrete would have a span of at least 330m if the pier positions were in the same place as the existing piers for the arch. This would make it the longest of its type in the world to date by some 30m. It would also require a depth at the pier of about 17m. On the south side, the sloping deck soffit required to achieve this depth would impinge on the clearance for the Manchester Ship Canal and is therefore unacceptable (Figure 8.4a). The level of the deck cannot be raised to a sufficient degree, as this would prevent the tie in with the existing road alignments at each end (Figure 8.4b).

A multi span viaduct is a better option in this case. A balanced cantilever form of construction with two spans of approximately 170m-200m to span the ship canal and River Mersey navigable channel would be possible. In this case, the main pier in the river channel would be on Church Bank, with the other piers on the bank south of the ship canal and near the north pier of the arch. The road level would need to be raised to a degree to maintain the navigable clearances (Figure 8.4c & 8.4d).

Alternatively, a multi span viaduct with piers near those of the railway bridge could be provided. With a maximum span of approximately 120m over the ship canal, the construction depths could be lower. This could be a balanced cantilever structure or a viaduct of constant depth (Figure 8.4e) In the later case, steel girders or incremental launching could be used.

Any multi span option would require more piers in the river channel, potentially restricting natural flows in the river. Also, the high flows at Runcomb Gap and the proximity of the existing arch make construction of piers in the river channel a high risk operation.

8.5.6 Recommendations

The longest span structures with the main supports placed symmetrically about the centre of the existing arch are extremely difficult to fit into the existing road alignment without
substantially increasing the extent of demolition required. They would also have the highest capital cost.

The medium span structures with towers just onto the river bank are feasible, but are likely to be rejected aesthetically due to the lack of symmetry when constructed alongside the existing structure. They do have the advantage of avoiding any piers in the river channel and therefore should still be considered.

Multi span structures are structurally feasible but will require additional piers in the river channel. The construction of these piers in fast flowing conditions adjacent to the existing structures is an inherently dangerous task incurring unacceptable risks to life and infrastructure.

It is considered that only the long span option should be taken forward and considered in more detail, while an arch structure echoing the existing Silver Jubilee Bridge is possible, it is not the most economic form of crossing. For lowest cost, a cable-stayed bridge will be considered and compared with the other route options.

8.6 Route 2 – Bridge Between Astmoor Interchange and West of Rhodia

8.6.1 Route Description

Route 2 is approximately one kilometre upstream from the Silver Jubilee Bridge. It starts on the south side of the river at the junction between Astmoor Road and the Bridgewater Expressway, crosses the ship canal and the edges of the salt marshes before crossing the estuary. On the north bank, it crosses the salt marshes, St. Heleens Canal and railway line before joining Ashley Way to the west of Rhodia.

8.6.2 Bridge Options

The Report of Works 1 described four possible structural options for a crossing at this location:

1. Short Spans: Continuous 100m span viaduct
2. Medium Spans: Approximately 300m cable stayed spans across the estuary with 100m approach spans
3. Two Span: Two cable stayed spans of approximately 450m across the estuary with 100m approach spans
4. Single Span: A single hybrid cable stayed/suspension span of approximately 900m across the estuary with 100m approach spans

These forms of structures were generic types that could be used for each route option across the central area of the study area.

8.6.3 Review of Structural Types

For Route 2 in particular, the length of the estuary crossing is approximately 1250m between the edges of the salt marshes. The number of spans required for the given alternatives are as follows:
1. Short Spans: 13 No. 100m spans
2. Medium Spans: 4 No. 320m cable stayed spans
3. Two Span: 2 No. 625m cable stayed spans
4. Single Span: 1 no. 1250m span

The tower height for the two span cable-stayed and single span hybrid options would exceed the limit for navigation clearance at Liverpool airport. Also, the capital cost of the single span option would be much higher than that for the other options and is likely to prove uneconomic.

8.6.4 Recommendations

The short span and medium span options will be taken forward for further consideration.

8.7 Route 2A – Bridge Between Astmoor Interchange and East of Rhodia

8.7.1 Route Description

Route 2A is approximately 1.25 km upstream from the Silver Jubilee Bridge. It starts on the south side of the river at the junction between Astmoor Road and the Bridgewater Expressway, crosses the ship canal and the edges of the salt marshes before crossing the estuary. On the north bank, it crosses the salt marshes, St. Helens Canal and railway line before joining Ashley Way to the east of Rhodia at Bowers Business Park Roundabout. The Runcorn terminal junction at Astmoor and the Widnes terminal junction at Widnes will be as defined in Route 2 and 3/3A respectively.

8.7.2 Recommendations

Route 2A has not been developed for the following reasons:

- Route 2A is a longer route when compared with routes 2,3 and 3A and therefore will not provide a significant reduction to traffic using the Silver Jubilee Bridge;

- The existing Bridgewater expressway junction with Astmoor road will need to be modified and a new grade separated interchange linking the new crossing with Bridgewater expressway formed. Full access between Bridgewater expressway and the new crossing can be provided. However, direct access between Bridgewater expressway and Astmoor road cannot be provided at the proposed grade separated interchange. Access will be indirect, via the Daresbury expressway junction with Astmoor spine road;

- The proximity of the proposed north terminal junction at Bowers Business Park roundabout with the Widnes Eastern Bypass/ Fiddlers Ferry Road Cross roundabout is not ideal for drivers at a busy urban location.

8.8 Route 3 – Bridge Between Central Expressway and East of Rhodia

8.8.1 Route Description
Route 3 is approximately 1.8 km upstream from the Silver Jubilee Bridge. It starts on the south side of the river at the junction of the Bridgewater, Daresbury and Central Expressways, crosses Astmoor Industrial Estate, the ship canal and the edges of the salt marshes before crossing the estuary. On the north bank, it crosses the salt marshes, St. Helens Canal and railway line before joining Ashley Way to the east of Rhodia.

8.8.2 Bridge Options

The Report of Works 1 described four possible structural options for a crossing at this location.

1. Short Spans: Continuous 100m span viaduct
2. Medium Spans: Approximately 300m cable stayed spans across the estuary with 100m approach spans
3. Two Span: Two cable stayed spans of approximately 450m across the estuary with 100m approach spans
4. Single Span: A single hybrid cable stayed/suspension span of approximately 900m across the estuary with 100m approach spans

These forms of structures were generic types that could be used for each route option across the central area of the study area.

8.8.3 Review of Structural Types

For Route 3 in particular, the length of the estuary crossing is approximately 1250m between the edges of the salt marshes. The number of spans required for the given alternatives are as follows:

1. Short Spans: 9 No. 100m spans
2. Medium Spans: 3 No. 320m cable stayed spans
3. Two Span: 2 No. 460m cable stayed spans
4. Single Span: 1 no. 920m span hybrid structure

The capital cost of the single span option would be much higher than that for the other options and is unlikely to prove economic.

8.8.4 Recommendations

The short span, medium span and two span options will be taken forward for further consideration.

8.9 Route 3A – Bridge Between Central Expressway and West of Rhodia

8.9.1 Route Description

Route 3A is approximately 1.6 km upstream from the Silver Jubilee Bridge. It starts on the south side of the river at the junction of the Bridgewater, Daresbury and Central Expressways, crosses Astmoor Industrial Estate, the ship canal and the edges of the salt marshes before crossing the estuary. On the north bank, it crosses the salt marshes, St. Helens Canal and railway line before joining Ashley Way to the west of Rhodia.
8.9.2 Bridge Options

The Report of Works described four possible structural options for a crossing at this location:

1. Short Spans: Continuous 100m span viaduct
2. Medium Spans: Approximately 300m cable stayed spans across the estuary with 100m approach spans
3. Two Span: Two cable stayed spans of approximately 450m across the estuary with 100m approach spans
4. Single Span: A single hybrid cable stayed/suspension span of approximately 900m across the estuary with 100m approach spans

These forms of structures were generic types that could be used for each route option across the central area of the study area.

8.9.3 Review of Structural Types

For Route 3A in particular, the length of the estuary crossing is approximately 1100m between the edges of the salt marshes. The number of spans required for the given alternatives are as follows:

1. Short Spans: 12 No. 100m spans
2. Medium Spans: 3 No. 360m cable stayed spans
3. Two Span: 2 No. 550m cable stayed spans
4. Single Span: 1 no. 1100m span

The tower height for the two span and single span options would exceed the limit for navigation clearance at Liverpool airport. Also, the capital cost of the single span option would be much higher than that for the other options and is likely to prove uneconomic.

8.9.4 Recommendations

The short span and medium span options will be taken forward for further consideration.

8.10 Route 4 – Bridge at Fiddler’s Ferry

8.10.1 Route Description

Route 4 is approximately 4.5 km upstream of the Silver Jubilee Bridge. It starts from Daresbury Expressway at Manor Park and heads northwards to the river crossing at Fiddlers Ferry. Once across the river it skirts the edge of the power station lagoons on embankment before crossing the salt marshes, St. Helens canal and the railway line on a separate structure and joining Fiddlers Ferry Road west of the power station.

8.10.2 Bridge Options

A clear span of approximately 300m is required across the river channel at this location. Realistically this restricts the form of structure to an asymmetric cable stayed or a bow string arch type structure. Each would have approach viaducts of approximately 100m.
The approach spans on the south side travel along the corridor of the Vymwy Aqueduct. This is a number of water pipes up to 56" in diameter and is a major water supply for Liverpool. Access along the aqueduct needs to be maintained therefore construction of an embankment across the top would not be permitted. Similarly, the pipes cannot be moved, therefore the deck above would need to be on portal type supports to keep the pier positions clear of the pipeline.

The secondary structure north of the lagoons can be a split deck continuous viaduct. Spans beneath each carriageway would vary to suit the skew crossing of the St. Helens canal and railway line.

8.10.3 Recommendations

For ease of construction, an asymmetric cable stayed structure is proposed as the main crossing at this location.

8.11 Tunnel

In view of the sensitive nature of the estuary and comments received during the early stages of consultation it was felt that consideration should be given to the possibility of constructing a tunnel under the estuary as an alternative to a bridge crossing. The constraints that were taken into account when deciding on possible routes included:

- Topography
- Links into the existing road network
- The Manchester Ship Canal and Bridgewater Canal
- Railway lines

Taking the constraints into account, three potential routes for a tunnel have been identified as indicated in Figure 8.5.
8.11.1 West 1

Route West 1 would be accessed at the south end from the Weston Expressway. Access into the tunnel would be restricted to northbound traffic only because of the limitations on space and topography in the vicinity of this junction. The tunnel then curves to the north west and passes under the Manchester Ship Canal and Mersey Estuary (which is a SSSI, SPA and RAMSAR site in this area) before rising beneath Pickering’s Pasture Nature Reserve and emerging in the vicinity of Pickering’s Farm.

The route would then be constructed as a dual 2 carriageway to link into the A5300 at the existing junction with Speke Road. The road section would impact on a number of residential properties and farms and would require structures over two existing roads and one railway line. The tunnel could be extended further north to minimise the impact on the farms and countryside but the increased costs would be significant.

Of the three options West 1 is potentially the shortest tunnel and could provide the opportunity to utilise tunnel arisings to construct the road required at the north end.

8.11.2 West 2

Route West 2 would have the same connection into the Weston Expressway as West 1 but would curve to the north east under the Manchester Ship Canal, River Mersey and A553 and link into the existing Speke Road Roundabout.

This route would have minimal impact on residential areas but would have some impact on existing industrial areas.
8.11.3 East 1

Route East 1 would be accessed from the Central Expressway near the existing roundabout which provides access to Shopping City at Halton Lea. The tunnel would then curve to the north west beneath the residential area of Hatton Brook, Astmoor Industrial Estate, the Manchester Ship Canal, the River Mersey, Spike Island and industrial areas immediately to the north of West Bank before joining the existing road network at the Speke Road Roundabout.

This route would have an impact on residential and industrial areas.

8.11.4 Tunnel Details

For all routes the tunnel would comprise twin 10.6m internal diameter bores, 16m apart, taking two 3.55m wide lanes in each direction with 1.2m wide verges/footways and a 2.1m high by 1.4m wide service gallery beneath the roadway. The headroom would be 5.55m and all equipment within the tunnel would be kept outside the traffic gauge.

Escape routes would be provided by cross-connecting passages between the twin bores at 100m nominal centres. These passages would be a minimum of 2.3m high by 1.6m wide and would have fire doors at both ends. Emergency points would need to be provided every 50m to accommodate fire-fighting facilities and emergency roadside telephones.

Longitudinal mechanical ventilation would be used within the tunnels. Plant rooms would be located at each tunnel portal and in the middle of the tunnel and a service building provided with a service area for police/rescue vehicles.

8.11.5 Construction Methods

In view of the sensitive nature of the estuary it is considered likely that a bored tunnel would be the only acceptable option. The approach roads would be lowered in open cut or between retaining walls, where land-take is restricted, up to the tunnel portal. The tunnel would then probably be advanced using a cut and cover method until the depth is sufficient to commence boring. Geological information relating specifically to tunnel construction is limited for all routes and a detailed ground investigation would be required to determine whether the construction of a tunnel on any of the routes is feasible.

8.12 Summary of Options Taken Forward

In summary, options considered to be viable alternatives are:

- Route 1
- Route 2
- Route 3
- Route 3A
- Route 4
- Tunnel

The locations of these alternatives are shown on Figure 8.6.
9. **PROPOSED DESIGN STANDARDS**

Details of the proposed design standards to be used for the scheme are given in Technical Report No B4027/TR19/01.

10. **GEOTECHNICAL DESIGN**

Details of the geotechnical design parameters to be used for the scheme are given in Technical Report No B4027/15/01.

11. **TRANSPORT ASSESSMENT**

The transport impact assessment is contained in Technical Report No B4027/TR09/01.
12. COSTS

Details of the scheme costs, optimism bias factors and the Quantified Risk Assessment are given in Technical Report No B4027/TR17/01. A summary of the costs for each scheme option is given below.

<table>
<thead>
<tr>
<th>Route</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Route 4</th>
<th>Tunnel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>450m</td>
<td>500m</td>
<td>600m</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Date</td>
<td>Minimum</td>
<td>Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Day</td>
<td>£m</td>
<td>£m</td>
<td></td>
<td>£m</td>
</tr>
<tr>
<td>Preliminaries</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Bridge (Tunnel)</td>
<td>71</td>
<td>72</td>
<td>100</td>
<td>85</td>
<td>114</td>
</tr>
<tr>
<td>Other Structures</td>
<td>29</td>
<td>10</td>
<td>10</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Highways Works</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Environmental Mitigation</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Service Diversions</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Contamination Treatment</td>
<td>0.3</td>
<td>0.1</td>
<td>0.7</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Sub Total 1 (GT1)</td>
<td>114</td>
<td>114</td>
<td>114</td>
<td>128</td>
<td>128</td>
</tr>
<tr>
<td>Off Site Works</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
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<tr>
<td>Contingency (10% of GT1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>*See Optimism Bias Below</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub Total 2 (GT2)</td>
<td>125</td>
<td>128</td>
<td>129</td>
<td>134</td>
<td>134</td>
</tr>
<tr>
<td>Fees (5% of GT2)</td>
<td>6.3</td>
<td>6.5</td>
<td>6.5</td>
<td>6.8</td>
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<td>Land</td>
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<td>0.5</td>
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<tr>
<td>Demolition</td>
<td>2.6</td>
<td>0.2</td>
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<tr>
<td>On Minimum Costs</td>
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<td>0</td>
<td>0</td>
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<td>Total Cost £m</td>
<td>158</td>
<td>158</td>
<td>158</td>
<td>172</td>
<td>172</td>
</tr>
<tr>
<td>Total Cost *Optimism Bias (4%)</td>
<td>326</td>
<td>51</td>
<td>129</td>
<td>263</td>
<td>263</td>
</tr>
<tr>
<td>Total Cost *Optimism Bias (6%)</td>
<td>555</td>
<td>12</td>
<td>229</td>
<td>429</td>
<td>429</td>
</tr>
</tbody>
</table>
## 13. ASSESSMENT OF OPTIONS AGAINST SCHEME OBJECTIVES

<table>
<thead>
<tr>
<th>Route</th>
<th>Main Span Options</th>
<th>Main Span Length</th>
<th>Relieve Silver Jubilee Bridge</th>
<th>Maximize Development Opportunities</th>
<th>Improve Public Transport</th>
<th>Encourage Cycling and Walking</th>
<th>Does Route Meet Scheme Objectives?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 1</td>
<td>Cable stayed</td>
<td>433m</td>
<td>The provision of a new bridge upstream of Silver Jubilee Bridge was well and fully satisfied. The new bridge has also been designed to allow for future expansion and development.</td>
<td>Congestion relief will improve access to existing areas of development but access to new areas is not provided.</td>
<td>Public transport would be able to use either bridge with priority lanes up to some junctions but not with priority lanes on the crossings. Congestion relief will improve existing public transport provision.</td>
<td>Cycling and pedestrian facilities on the SJB will be improved.</td>
<td>Yes</td>
</tr>
<tr>
<td>Route 2</td>
<td>Short Spans</td>
<td>100m</td>
<td>The traffic congestion analysis shows that approximately 39% of traffic was attracted to the Silver Jubilee Bridge and 33% of crossing traffic was towards the New Money. The new crossing will reduce the SJB to two lanes.</td>
<td>Congestion relief will improve access to existing areas of development and access to Ashmore and southeast Warrnambool is improved.</td>
<td>Public transport would be able to use either bridge with priority lanes up to some junctions but not with priority lanes on the crossings. Congestion relief will improve existing public transport provision and new route allows additional public transport routes to be opened up.</td>
<td>Cycling and pedestrian facilities on the SJB will be improved.</td>
<td>Yes</td>
</tr>
<tr>
<td>Route 3</td>
<td>Medium Spans</td>
<td>500m</td>
<td>Although the bridge has no greater benefits than Route 2, it attracts significantly less traffic than Route 2 due to the configuration of the junction and the alignment of the route. It is classified whether the use of the new bridge would be to its advantage. The Silver Jubilee Bridge could be converted to two lanes. Consequently, the objectives of the crossing would not be met and the route should therefore be rejected.</td>
<td>Limited congestion relief would mean that access to development opportunities would be greatly restricted.</td>
<td>Public transport would be able to use either bridge with priority lanes up to some junctions but not with priority lanes on the crossings. Congestion relief will improve existing public transport provision and new route allows additional public transport routes to be opened up.</td>
<td>Cycling and pedestrian facilities on the SJB will be improved.</td>
<td>No</td>
</tr>
<tr>
<td>Route 4</td>
<td>Long Spans</td>
<td>480m</td>
<td>The analysis and mapping of the traffic flows for the right-of-way analysis shows that the Silver Jubilee Bridge would attract approximately 21% of traffic in the design year (2022). Route 4A consists of a significant traffic alternative as Bridgewater Expressway with peak flows in the design year of less than 1000 vehicles per hour. The equivalent value trend across Central Expressway up to 1985 was substantially increased, resulting in peak flows of 6950 vehicles per hour.</td>
<td>Congestion relief will improve access to existing areas of development and access to Ashmore and southeast Warrnambool is improved.</td>
<td>Public transport would be able to use either bridge with priority lanes up to some junctions but not with priority lanes on the crossings. Congestion relief will improve existing public transport provision and new route allows additional public transport routes to be opened up.</td>
<td>Cycling and pedestrian facilities on the SJB will be improved.</td>
<td>Yes</td>
</tr>
<tr>
<td>Route 5</td>
<td>Short Spans</td>
<td>100m</td>
<td>The analysis and mapping of the traffic flows for the right-of-way analysis shows that the Silver Jubilee Bridge would attract approximately 21% of traffic in the design year (2022). Route 4A consists of a significant traffic alternative as Bridgewater Expressway with peak flows in the design year of less than 1000 vehicles per hour. The equivalent value trend across Central Expressway up to 1985 was substantially increased, resulting in peak flows of 6950 vehicles per hour.</td>
<td>Congestion relief will improve access to existing areas of development and access to Ashmore and southeast Warrnambool is improved.</td>
<td>Public transport would be able to use either bridge with priority lanes up to some junctions but not with priority lanes on the crossings. Congestion relief will improve existing public transport provision and new route allows additional public transport routes to be opened up.</td>
<td>Cycling and pedestrian facilities on the SJB will be improved.</td>
<td>Yes</td>
</tr>
<tr>
<td>Route 6</td>
<td>Medium Spans</td>
<td>500m</td>
<td>The analysis and mapping of the traffic flows for the right-of-way analysis shows that the Silver Jubilee Bridge would attract approximately 21% of traffic in the design year (2022). Route 4A consists of a significant traffic alternative as Bridgewater Expressway with peak flows in the design year of less than 1000 vehicles per hour. The equivalent value trend across Central Expressway up to 1985 was substantially increased, resulting in peak flows of 6950 vehicles per hour.</td>
<td>Congestion relief will improve access to existing areas of development and access to Ashmore and southeast Warrnambool is improved.</td>
<td>Public transport would be able to use either bridge with priority lanes up to some junctions but not with priority lanes on the crossings. Congestion relief will improve existing public transport provision and new route allows additional public transport routes to be opened up.</td>
<td>Cycling and pedestrian facilities on the SJB will be improved.</td>
<td>Yes</td>
</tr>
<tr>
<td>Route 7</td>
<td>Long Spans</td>
<td>480m</td>
<td>The analysis and mapping of the traffic flows for the right-of-way analysis shows that the Silver Jubilee Bridge would attract approximately 21% of traffic in the design year (2022). Route 4A consists of a significant traffic alternative as Bridgewater Expressway with peak flows in the design year of less than 1000 vehicles per hour. The equivalent value trend across Central Expressway up to 1985 was substantially increased, resulting in peak flows of 6950 vehicles per hour.</td>
<td>Congestion relief will improve access to existing areas of development and access to Ashmore and southeast Warrnambool is improved.</td>
<td>Public transport would be able to use either bridge with priority lanes up to some junctions but not with priority lanes on the crossings. Congestion relief will improve existing public transport provision and new route allows additional public transport routes to be opened up.</td>
<td>Cycling and pedestrian facilities on the SJB will be improved.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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**New Money Crossing**

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Gifford and Partners

Report No. 84027002
14. DESCRIPTION OF THE ROUTES

This section describes in more detail the highways and structures required on those routes which are considered to be viable.

14.1 Route 1

14.1.1 Highways Alignment Description

The proposed alignment forms a link across the River Mersey upstream of the Silver Jubilee Bridge. The alignment links the Weston Point and Bridgewater Expressways in Runcorn with Speke Road, Ditton Roundabout and Widnes Eastern Bypass in Widnes.

In Runcorn, the expressway links onto the Silver Jubilee Bridge will be remodelled as follows:

1. A new link will be formed to connect Station Road and Church Street with the Silver Jubilee Bridge. The Silver Jubilee Bridge will then become a route for local, public transport and pedestrian/cyclist traffic.

2. Four new links will be formed to provide links from the new crossing to Northbound and Southbound traffic from Weston Point and Bridgewater Expressways.

3. The existing link between the Bridgewater and Weston Point Expressway will be realigned.

In Widnes links to Widnes Town Centre, Widnes Eastern Bypass, Speke Road and Speke Road Roundabout will be remodelled as follows:

1. The local traffic from the Silver Jubilee Bridge will tie-in to Waterloo Road.

2. New links with Widnes Eastern Bypass and Speke Roundabout will be provided for Southbound and Northbound traffic using the new crossing.

3. Direct links will also be provided with Speke Road for Northbound and Southbound traffic using the new crossing.

14.1.2 Structure - Main Spans

Cable Stayed Span

Details of the cabled stayed span option are given on drawings B4027/2/B/111 and 112.

This option will provide a cable stayed crossing of both the river and the Manchester Ship Canal in a single 435m span. The towers for the bridge would be to the south of the ship canal and on the mud flats adjacent to the river wall at West Bank.

On the south side of the river the road starts to curve back towards the existing highway approximately 100m from the edge of the ship canal. On the north side
the curve begins approximately 20m south of the riverbank. A cable stayed bridge needs the horizontal force in the main span stay cables at the tower to be balanced in some way. Back span cables providing an approximately equal counter force usually achieve this balance. Usually the cables are taken back to the deck so that a balancing compressive force is achieved at deck level to keep the system in equilibrium.

In this case, if the cables were anchored to the deck there would be a transverse out of balance at the tower due to the different line of action of cables anchored in the straight main span compared to the line of action of the cables anchored in the curved back spans. To overcome this problem, the back stays will be taken to separate stressing galleries to be constructed alongside the highway. These galleries will be anchored back to the bedrock using rock anchors. The splay of the cables on each side of each tower will be equal to ensure equilibrium.

The need to splay the cables largely dictates the form of the tower. An A-shaped tower with the main stem central above the deck would require a greater splay and would push the stressing galleries further out, requiring a greater land take. A H-shaped tower allows the cables to be as close to the deck as possible, minimising the required land take. However, the splay will tend to pull the legs of the H-shaped tower apart, therefore cross beams will be required at the top of the tower to balance the stay forces.

Using discrete stressing galleries removes the problem of an out of balance force in the towers, but still leaves the problem of the compressive force in the deck. For stays anchored on the back span of the deck, the force in the back span would balance the compressive force in the main span. Since this does not occur in this case, this force in the deck needs to be accommodated by a rigid connection at the tower that will accommodate the shear and bending effects induced by the compression in the deck. Thus the size of the cross section at the base of the tower needs to be much larger than that above deck level.

The deck itself will be a 2.5m deep continuous concrete deck built in at both towers. Changes in the length of the deck due to thermal effects will be accommodated by flexure. It will comprise two outer longitudinal edge beams supporting prestressed transverse beams at approximately 5m centres that in turn support a reinforced concrete slab spanning longitudinally. The stay cables will be anchored adjacent to the edge beams, which will carry the corresponding compressive force.

14.1.3 Structure - Approach Spans.

The approach spans will be 2.5m deep prestressed concrete cellular structures with spans of 50m or as necessary to suit the tie ins with the existing road alignment. Local thickening of the webs and bottom slab will be required at pier positions to accommodate shear and moment effects.

There will be two piers at each support position, one beneath each carriageway. These will comprise square reinforced concrete sections.
14.1.4 Other Structures

a) Weston Point Expressway Interchange

An approximate layout of the necessary structures at Weston Point Expressway Interchange is shown on drawing B4027/2/B/501. These structures will replace the existing bridge access roads, which will be demolished.

South of the river the new crossing will link into the existing road network at the Weston Point Expressway Interchange. The proximity of the expressway to the end of the bridge and the need to tie into the existing junction necessitate a very complex arrangement at this interchange.

New viaducts will be required for both the on and off slip roads from the new bridge to the existing expressway in both directions. The on slip road from the east will be a high level viaduct crossing above the other slip roads. These other roads will be at a mid level crossing above the local access roads and the through roads on the expressway.

The lowest level of viaduct will be the local access roads. A new link will be provided from the existing bridge heading towards Runcorn town centre. This will drop from the end of the bridge to tie in with the existing busway. Extending from this viaduct will be the access to the railway station. This will span the busway across the Bridgewater canal and the through roads for the expressway to the end of Cavendish Street near the Railway Station.

A summary of the new structures required together with their approximate length is given in Table 14.1.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>On slip from East</td>
<td>Viaduct</td>
<td>500</td>
<td>High level viaduct crossing above other slip roads</td>
</tr>
<tr>
<td>On slip from west</td>
<td>Viaduct</td>
<td>330</td>
<td>Medium level viaduct above local roads</td>
</tr>
<tr>
<td>Off slip to east</td>
<td>Viaduct</td>
<td>460</td>
<td>Medium level viaduct above local roads</td>
</tr>
<tr>
<td>Off slip to west</td>
<td>Viaduct</td>
<td>330</td>
<td>Medium level viaduct above local roads</td>
</tr>
<tr>
<td>Runcorn access ramp</td>
<td>Viaduct</td>
<td>110</td>
<td>New low level viaduct for two way traffic from the existing bridge towards Runcorn town centre</td>
</tr>
<tr>
<td>Railway Station access</td>
<td>Viaduct</td>
<td>120</td>
<td>Low level viaduct for two way traffic crossing the expressway to link to the station area</td>
</tr>
<tr>
<td>Bridgewater Canal Wall</td>
<td>Retaining Wall</td>
<td>170</td>
<td>Retaining wall up to 5m approximate height</td>
</tr>
</tbody>
</table>

Table 14.1 Approach Structures at Weston Point Expressway Interchange
b) **Speke Road Interchange**

An approximate layout of the necessary structures at Speke Road Interchange is shown on drawing B4027/2/B/502.

North of the river the new crossing will initially link into the existing Queensway Viaduct. Some strengthening works/widening may be required to this viaduct. Local traffic on the existing bridge will use the existing slip road towards Ashley Way to gain access. This road will be diverted to join Waterloo Road, providing the local access to West Bank.

The new road will be the main route for all through traffic. The existing Queensway viaduct towards Liverpool will be realigned on a new structure between Dock Road and the flyover at Ditton Roundabout. The off slip road for north bound traffic will be built on embankment and will pass under this new viaduct. It then splits to join Ashley Way to the east and crosses the railway line on a new structure to link with Ditton Roundabout in the west. The on slip road from Ditton Roundabout crosses over the railway line, the east bound off slip round and a new access road before rising on embankment to join a new viaduct that crosses Dock Road and links into the existing Queensway Viaduct. The on slip road from Ashley Way also rises on embankment to meet this viaduct.

A summary of the new structures required together with their approximate length is given in Table 14.2.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realigned Queensway Viaduct</td>
<td>Viaduct</td>
<td>480</td>
<td>Joins onto existing structures at each end</td>
</tr>
<tr>
<td>Southbound slip round viaduct</td>
<td>Viaduct</td>
<td>220</td>
<td>Joins existing Queensway Viaduct at south end</td>
</tr>
<tr>
<td>North bound rail crossing</td>
<td>Bridge</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>South bound rail crossing</td>
<td>Bridge</td>
<td>65</td>
<td>Also spans east bound off slip road and a new access road.</td>
</tr>
</tbody>
</table>

**Table 14.2 Approach Structures at Speke Road Interchange**
14.1.1 Foundations

**Route 1: Structures located at the Runcorn Gap adjacent to the Silver Jubilee Bridge**

**Generalised Ground Conditions:**
Rock strata are exposed on the foreshore at West Bank. The rockhead decreases towards the north across Runcorn Gap forming the southern channel of the River Mersey (to approximately -8m OD) however the rockhead remains shallow rising in the vicinity of the Manchester Ship Canal, which is cut into the sandstone bedrock. Sandstone encountered at c. +2m OD at the south bank of the Ship Canal.

<table>
<thead>
<tr>
<th>Form of Bridge Structure</th>
<th>Advantage/Disadvantage</th>
<th>Foundations bearing on Rock</th>
<th>Foundations bearing in Superficial Deposits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABLE STAYED STRUCTURE</td>
<td></td>
<td>Rock outcrops c. at surface. Will only require minimal excavation for foundation construction in unweathered strata. No piers in estuary and are placed outside of the existing bridge piers. Need for temporary cofferdams etc significantly reduced. Cable/anchor headworks systems can be constructed directly to shallow rock. Minimal temporary works required in the river estuary (N tower only).</td>
<td>Not applicable, no substantial superficial deposits within river estuary to utilise.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advantages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disadvantages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APPROACH ROADS</td>
<td>Reduced number of piers, or possibly smaller diameter piers would be needed to rock. Note rockhead decreases into buried glacial channel N of West Bank.</td>
<td>The glacial material away from the river estuary is predominantly cohesive therefore founding in this material would provide increased protection for the underlaying aquifer. Only shorter piers would likely be needed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Route 1: Structures located at the Runcorn Gap adjacent to the Silver Jubilee Bridge

<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Route 1 has distinct areas of contamination, including 'gallipoo' which is discussed further in Technical Annex 4. Environmental aspects of piling and penetrative ground engineering.</th>
<th>Superficial deposits may not be suitable for the imposed design loads with practicable foundation solutions. Piles may need to be increased diameter to cope with imposed loads. Would most likely need shorter spans compared to founding on rock.</th>
<th>Approach embankments: implications on land take, import of fill, bearing and settlement considerations.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACCOMMODATION STRUCTURES</strong></td>
<td><strong>Advantages</strong></td>
<td><strong>Possibility of increased spans with economical foundations on rock</strong></td>
<td><strong>Glacial material in abundance, predominantly cohesive, which maintains aquifer protection. Larger diameter but shallower piles: economical balance to be determined.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Disadvantages</strong></td>
<td><strong>Number of elevated fly-over for route 1 would necessitate significant pile construction through contaminated areas. Rock potentially deep where these structures are situated, which may require longer/expensive piles.</strong></td>
<td><strong>Cost saving of increased diameter but shallower piles? Superficial deposits and alluvial deposits potentially not strong enough for practicable foundation solution. Settlement considerations.</strong></td>
</tr>
</tbody>
</table>

### 14.2 Route 2

#### 14.2.1 Highways Alignment Description

The proposed alignment will form a dual 2 lane all-purpose standard road link, D2AP, with hardshoulders from the Astmoor interchange in Runcorn to A557 Ashley Way, West of the Rhodia works, in Widnes. A new dual 2 lane all-purpose road is also proposed to form a link between the A557 Widnes Eastern bypass and A553 Speke Road at Ditton Roundabout.

A new high-level roundabout, with slip roads in both directions onto the Bridgewater Expressway is proposed at the existing Astmoor junction. The existing Astmoor junction serving the Astmoor Industrial Park will be remodelled to form a signalised junction between Astmoor Road and the Bridgewater Expressway. The signalised junction will be at a lower level to the interchange. The Astmoor interchange will not permit traffic to transfer directly between the crossing and Astmoor Road. Through traffic on Bridgewater Expressway will have the option of travelling through the signals at low level or, by negotiating the roundabout at high-level.

The Rhodia roundabout is at low level and passes beneath the Garston to Timperley Freight Line. The new roundabout will provide links into Ashley Way and Speke Road.
The Speke Road link passes over Victoria Road and the Garston to Timperley Freight Line at a high level onto Speke Road at the Ditton Roundabout.

14.2.2 Structure - Main Spans

a) Option 1: Short Span

Details of the short span option are given on drawing B4027/2/B/211.

This option will provide a continuous viaduct across the estuary with spans of around 100m. There will be some variation in the spans to suit local obstacles, such as the ship canal and possible areas of contamination that need to be avoided. A separate deck will be provided for each carriageway. The deck will comprise reinforced concrete slabs separated by cast steel lattice webs. Overall depth of the deck will be 7m – a depth easily capable of spanning the required 100m or slightly more.

Pairs of piers at the support positions will support the deck. The river channel is highly mobile and therefore the direction of the flow can vary considerably. In order to minimise the effect of the piers on the flow, the pier cross section should present the same aspect regardless of the flow direction. Square piers would provide the optimum solution in terms of ease of construction and costs however these would also be the worst in terms of obstruction to the river flow. Ideally, circular piers should be used, however these would present difficulties in construction and increased costs to achieve the circular cross section. As a compromise, the piers will be octagonal in cross section to allow as smooth a flow as possible. The pier stems would be taken to below river bed level in order to minimise any obstruction to river flow and reduce scour.

b) Option 2: Medium Span

Details of the medium span option are given on drawings B4027/2/B/221 and 222.

This option will provide a series of four cable stay spans each 320m in length with back spans at each end of 160m. The deck will be split to carry each carriageway. It will be 7m deep with reinforced concrete slabs and cast steel webs, similar to the short span option, giving a continuous depth through the approach spans and cable stayed spans.

There will be a single tower at each support position located between the two decks. The towers will each comprise a reinforced concrete octagonal section below deck level with a steel tower above deck level. They will support parallel stay cables on each side, giving a harped appearance to the structure. The stays will come down between the decks to anchor into steel frames that will be linked into the deck.

14.2.3 Structure - Approach Spans.

The approach spans for each option will be the same type of construction as the short span option, thus providing a continuous viaduct in each case.
Spans will be chosen to suit the tie in with the main river structure, the ship canal crossing and the position of the structures at the Astmoor Interchange.

There will again be two piers at each support location. These will be octagonal in section to match those in the river channel. Pier positions will also be adjusted locally to avoid obstructing access along Astmoor Road.

14.2.4 Other Structures

a) Astmoor Interchange

South of the river the new crossing will link into the existing road network at the Astmoor Interchange. An approximate layout of the necessary structures at Astmoor Interchange is shown on drawing B4027/2/B/503.

The existing Daresbury Expressway will be lowered and a new traffic light controlled junction formed. A high level roundabout will be constructed to link traffic from the new crossing into the existing expressway. Much of this roundabout will be constructed on embankment, however new bridge structures will be constructed across the expressway and Astmoor Road. These structures are likely to be reinforced or prestressed concrete built into reinforced concrete piers and abutments to make fully integral structures.

Retaining walls will also be required alongside the slip roads and along the south edge of the roundabout, adjacent to the Bridgewater Canal. It is anticipated that these retaining walls will be constructed from reinforced concrete although reinforced earth could also be used.

A summary of the new structures required together with their approximate length is given in Table 14.3.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daresbury Expressway Crossing East</td>
<td>Bridge</td>
<td>40</td>
<td>Crosses existing dual carriageway</td>
</tr>
<tr>
<td>Daresbury Expressway Crossing West</td>
<td>Bridge</td>
<td>40</td>
<td>Crosses existing dual carriageway</td>
</tr>
<tr>
<td>Astmoor Road Crossing</td>
<td>Bridge</td>
<td>50</td>
<td>Links into end spans of the main river crossing</td>
</tr>
<tr>
<td>East Approach North</td>
<td>Retaining Wall</td>
<td>55</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>East Approach South</td>
<td>Retaining Wall</td>
<td>70</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>West Approach North</td>
<td>Retaining Wall</td>
<td>50</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>West Approach South</td>
<td>Retaining Wall</td>
<td>50</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>Canal Side</td>
<td>Retaining Wall</td>
<td>70</td>
<td>Retaining wall constant 9m height</td>
</tr>
</tbody>
</table>

Table 14.3 Approach Structures at Astmoor Interchange
b) Rhodia Roundabout and the Speke Road Link

An approximate layout of the necessary structures at Rhodia Roundabout is shown on drawing B4027/2/B/504.

North of the river the new road crosses the St Helens Canal and links into a new roundabout west of Rhodia. The canal structure carries the main carriageway from the end abutment for the main bridge over the St Helens Canal. It will be a precast beam structure with in situ stitches at the piers and abutments to form a fully integral bridge.

The Rhodia Roundabout is at low level and passes beneath the Garston to Timperley Freight Line. Two new structures will be required to carry this line over the roundabout. These structures are likely to be formed using steel through girders that can be lifted into place during an overnight or weekend track possession.

The new roundabout will provide links into Ashley Way and also to a new link towards Speke Road. This new link road passes over Victoria Road on a new structure then crosses over the Garston to Timperley Freight Line at a high skew angle. The Victoria Road crossing is likely to be a reinforced concrete structure built in at the abutments. The high skew of the railway crossing make forming a conventional bridge structure difficult. Using a portal frame to form a "pseudo" tunnel for the railway is the recommended solution. Reinforced concrete abutment walls will be constructed each side of the railway and precast concrete beams lifted into place during a series of track possessions. These would then be covered with infill concrete to form the deck surface. Short reinforced concrete retaining walls will be required alongside the railway at each end of this structure. The link road finally crosses over the existing Speke Roundabout to join Speke Road. This structure will be formed using precast concrete beams integral with the abutments so that they can be lifted into place during brief road closures, thus minimising disruption.

A summary of the new structures required together with their approximate length is given in Table 14.4.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Helens Canal Crossing</td>
<td>Bridge</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Railway Crossing East</td>
<td>Bridge</td>
<td>20</td>
<td>Carries Garston to Timperley Freight Line over new road</td>
</tr>
<tr>
<td>Railway Crossing West</td>
<td>Bridge</td>
<td>20</td>
<td>Carries Garston to Timperley Freight Line over new road</td>
</tr>
<tr>
<td>Victoria Road</td>
<td>Bridge</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Railway Tunnel</td>
<td>Bridge</td>
<td>15</td>
<td>Approximately 175m long &quot;pseudo&quot; tunnel</td>
</tr>
<tr>
<td>Speke Roundabout</td>
<td>Bridge</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Railway Wall South</td>
<td>Retaining Wall</td>
<td>30</td>
<td>Retaining wall up to 6m approximate height</td>
</tr>
<tr>
<td>Railway Wall North</td>
<td>Retaining Wall</td>
<td>35</td>
<td>Retaining wall up to 6m approximate height</td>
</tr>
</tbody>
</table>

Table 14.4 Approach Structures at Rhodia Roundabout and Speke Road Link
### 14.2.5 Foundations

**Route 2: Structures located between the Runcorn Expressway and Spike Island, passing to the west of the Rhodia Plant**

**Generalised Ground Conditions:**
Rock strata are exposed in the cuttings of the Manchester Ship Canal. The bedrock level decreases below Wigg Island to a level of approximately -5m OD below the Southern channel. Rockhead remains at approximately -10m OD to the Northern channel and Spike Island where it decreases to c. -30m OD below the St Helens canal.

<table>
<thead>
<tr>
<th>Form of Bridge Structure:</th>
<th>Advantage/Disadvantage</th>
<th>Foundations bearing on Rock</th>
<th>Foundations bearing in Superficial Deposits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHORT SPAN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viaduct construction with c.100m spans between piers</td>
<td>Advantages</td>
<td>Rock at shallow depth, until Spike Island (north shore), therefore piling operations simplified/ relatively shallow piles.</td>
<td>Where superficial material is cohesive it offers some protection to the underlying aquifer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disadvantages</td>
<td>Rock becomes much deeper north of Spike Island; potentially deep piled foundations with additional works and cost implications</td>
<td>Geotechnical nature of superficial deposits unlikely to offer a viable foundation solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased temporary works for numerous pier positions especially those on the estuary saltmarshes.</td>
<td>Depth of superficial deposits within the river estuary likely to be shallow. Any glacial material within the river is likely to be granular, which would offer limited advantages in terms of protection to aquifer.</td>
<td></td>
</tr>
<tr>
<td>MEDIUM SPAN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Towers in River, 1 tower on the extremity of Wigg Island and 1 tower on Spike Island</td>
<td>Advantages</td>
<td>Reduced disturbance to river environment due to fewer piers in the estuary. Rock at reasonably shallow depth as far north as Spike Island</td>
<td>If the superficial material is cohesive it may offer some protection to the underlying aquifer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disadvantages</td>
<td>Significant temporary works and access implications for tower construction</td>
<td>May have difficulty achieving the required bearing capacity (for large piles) from the superficial deposits.</td>
<td>Geotechnical nature of superficial deposits unlikely to offer a viable foundation solution</td>
</tr>
<tr>
<td>APPROACH STRUCTURES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated carriageway off The Expressway in the south. Viaduct over St Helens canal; Embankments to lie in (north)</td>
<td>Advantages</td>
<td>Limited contaminated land present. The increased strength of rock compared to superficial deposits would allow a larger span width across adverse areas such as vicinity of BH1004 where a large alluvial channel has been encountered. This will allow more flexibility in bridge design.</td>
<td>Some aquifer protection. Rockhead is deep in the north, glacial till may be viable for piled foundations. Reduced risk to groundwater due to minimal excavation</td>
<td>Geotechnical considerations for embankments: bearing/settle ment/stability</td>
</tr>
</tbody>
</table>
### Route 2: Structures located between the Runcorn Expressway and Spike Island, passing to the west of the Rhodia Plant

<table>
<thead>
<tr>
<th>Item</th>
<th>Disadvantages</th>
<th>Advantages                                                                FINITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disadvantages</td>
<td>BH1004 and BH1005 show very rapid increase in depth to rockhead and an increase in thickness of alluvial material. This may cause problems with gaining sufficient bearing capacity for pier foundations</td>
<td>Smaller diameter piles may be a cost saving due to potentially smaller plant, ease of construction etc.</td>
</tr>
<tr>
<td>Embankment considerations in terms of imported fill, settlements/ stability etc on poor ground conditions: may require additional ground treatment or engineering</td>
<td>Glacial material in abundance, predominantly cohesive, which maintains aquifer protection</td>
<td>Likely cost effective for proposed foundation loads involved</td>
</tr>
<tr>
<td>ACCOMMODATION STRUCTURES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roundabout embankments, slip roads and canal overbridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advantages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Reduced loads of accommodation structures may prove unnecessary for piles to reach rock</td>
<td>Cost saving of increased diameter but shallower piles may be offset by need for specialist plant for larger diameter piles.</td>
</tr>
</tbody>
</table>

### 14.3 Route 3

#### 14.3.1 Highways Alignment Description

The proposed alignment will form a dual 2 lane all-purpose standard road link with hard shoulders, D2AP, from the existing Central /Daresbury/Bridgewater Expressway junction in Runcorn to the A557 Ashley Way in Widnes.

The new link, will tie-in directly with the Central Expressway in Runcorn. The existing Central Expressway will be made continuous with the new link, crossing the Daresbury Expressway on a new high-level flyover. Connection between Central, Bridgewater and Daresbury Expressways will be via a new roundabout that will be constructed at middle level with the Daresbury Expressway passing beneath at a lower level.

It is proposed to tie-in the new link with the A557 Ashley Way in Widnes via a new roundabout sited to the West of the Rhodia works. A dedicated bus lane providing a direct link onto the new crossing is also proposed at this location.

A new dual 2 lane all-purpose road is also proposed to form a link between the A557 Widnes Eastern bypass and A553 Speke Road at Ditton Roundabout.
14.3.2 Structure - Main Spans

a) Option 1: Short Span

Details of the short span option are given on drawing B4027/2/B/311.

This option will provide a continuous viaduct across the estuary with spans of around 100m. Construction details will be the same as for Route 2 Short Spans.

b) Option 2: Medium Span

Details of the medium span option are given on drawings B4027/2/B/321 and 322.

This option will provide a series of three cable stay spans each 320m in length with back spans at each end of 160m. Other details will be the same as Route 2 Medium Spans.

c) Option 3: Two Span

Details of the two span option are given on drawings B4027/2/B/331 and 332.

This option is similar to the medium span option except that the cable stayed spans are increased to 460m in length so that only two main spans are required to cross the river. The back spans will comprise two 100m spans with tension piers to counter the out of balance caused by the longer main span. Stays for the main span and back spans will be parallel. Other details will be the same as for the medium span option.

14.3.3 Structure - Approach Spans

The approach spans for each option will be the same type of construction as the short span option, thus providing a continuous viaduct in each case.

Span lengths will be chosen to suit the tie in with the main river structure, the ship canal crossing and the position of the structures at the interchanges at each end of the crossing.

There will be two piers at each support location. These will be octagonal in section to match those in the river channel.

14.3.4 Other Structures

a) Central Expressway Interchange

South of the river the new crossing will link into the existing road network at the Central Expressway Interchange. An approximate layout of the necessary structures is shown on drawing B4027/2/B/505.

The existing Central Expressway through Halton will be made continuous with the new road, crossing the Daresbury Expressway on a new high level flyover. Connection between the two expressways will be via a new roundabout that will be
constructed at a middle level, with the Daresbury Expressway passing beneath at a lower level. Apart from the main viaduct extending the Central Expressway across the interchange to the new river crossing, several other bridge structures will be required to take the new roundabout across the Daresbury Expressway and the Bridgewater Canal. All these structures will be formed using precast concrete beams built in at the supports to form integral structures. The use of precast beams will minimise disruption to the expressways during construction.

Generally, where structures are not required the roundabout and new road can be constructed on embankment. However, retaining walls will be required alongside the extension to the Central Expressway and also alongside the Bridgewater Canal and slip roads for the west bound carriageway. Reinforced concrete walls or reinforced earth could be used for these walls.

A summary of the new structures required together with their approximate length is given in Table 14.5.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Expressway Flyover</td>
<td>Viaduct</td>
<td>175</td>
<td>Crosses existing dual carriageway and roundabout at high level</td>
</tr>
<tr>
<td>Daresbury Expressway Crossing East</td>
<td>Bridge</td>
<td>45</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Daresbury Expressway Crossing West</td>
<td>Bridge</td>
<td>45</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Bridgewater Canal Crossing East</td>
<td>Bridge</td>
<td>40</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Bridgewater Canal Crossing West</td>
<td>Bridge</td>
<td>40</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Central Expressway South Approach East</td>
<td>Retaining Wall</td>
<td>75</td>
<td>Retaining wall up to 5m approximate height</td>
</tr>
<tr>
<td>Central Expressway South Approach West</td>
<td>Retaining Wall</td>
<td>70</td>
<td>Retaining wall up to 5m approximate height</td>
</tr>
<tr>
<td>Central Expressway North Approach East</td>
<td>Retaining Wall</td>
<td>55</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>Central Expressway North Approach West</td>
<td>Retaining Wall</td>
<td>45</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>Canal Side</td>
<td>Retaining Wall</td>
<td>60</td>
<td>Retaining wall constant 9m height</td>
</tr>
<tr>
<td>Daresbury Expressway West bound off slip</td>
<td>Retaining Wall</td>
<td>50</td>
<td>Retaining wall 6 to 8m approximate height</td>
</tr>
<tr>
<td>Daresbury Expressway West bound on slip</td>
<td>Retaining Wall</td>
<td>25</td>
<td>Retaining wall 6 to 8m approximate height</td>
</tr>
</tbody>
</table>

Table 14.5 Approach Structures at Central Expressway Interchange

b) Bowers Roundabout and the Speke Road Link

An approximate layout of the necessary structures at these links is shown on drawing B4027/2/B/506.

North of the river: the abutment for the new road is north of the St Helens Canal. The road then continues on embankment to a new crossing of the Garston to Timperley Freight Line and Earle Road before linking into the new Bowers...
Roundabout west of Rhodia on Ashley Way. Both these structures will be formed using precast concrete beams built into the abutments.

The west bound Ashley Way will be upgraded to form a new Speke Road Link that runs along the same line as that proposed for Route 2. The required structures along this link will be the same.

A summary of the new structures required together with their approximate length is given in Table 14.6.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Crossing</td>
<td>Bridge</td>
<td>20</td>
<td>Carries Garston to Timperley Freight Line over new road</td>
</tr>
<tr>
<td>Earle Road</td>
<td>Bridge</td>
<td>45</td>
<td>Crosses existing road and junction</td>
</tr>
<tr>
<td>Victoria Road</td>
<td>Bridge</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Railway Tunnel</td>
<td>Bridge</td>
<td>15</td>
<td>Approximately 175m long “pseudo” tunnel</td>
</tr>
<tr>
<td>Speke Roundabout</td>
<td>Bridge</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Railway Wall South</td>
<td>Retaining Wall</td>
<td>30</td>
<td>Retaining wall up to 6m approximate height</td>
</tr>
<tr>
<td>Railway Wall North</td>
<td>Retaining Wall</td>
<td>35</td>
<td>Retaining wall up to 6m approximate height</td>
</tr>
</tbody>
</table>

**Table 14.6 Approach Structures at Bowers Roundabout and Speke Road Link**

14.3.5 Foundations

**Generalised Ground Conditions:**
Rock strata are exposed in the cutting of the Manchester Ship Canal. The bedrock level decreases below Wigg Island to a level of approximately –10m OD below the Southern channel. The level varies between –10 and –15m OD across the estuary, decreasing below the northern River bank to a level of –30m OD beneath the edge of Spike Island. The buried glacial channel is postulated to lie below the alignment of the St Helens canal, from where rockhead rises once more to the north.

<table>
<thead>
<tr>
<th>Form of Bridge Structure:</th>
<th>Advantage/ Disadvantage</th>
<th>Foundations bearing on Rock</th>
<th>Foundations bearing in Superficial Deposits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHORT SPAN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viaduct structure with 100m spans – approx. 9 piers in the River with 4½ to either salt marsh area.</td>
<td>Advantages</td>
<td>See Route 2. Piled foundations to rockhead will be appropriate. Pile length will increase once the northern landfill is reached at Spike Island.</td>
<td>Cohesive materials will offer some protection to the underlying aquifer.</td>
<td></td>
</tr>
</tbody>
</table>

Route 3 revealed thicker superficial deposits within the river estuary than previous routes. Pile capacities in the drift deposits may be considered in detailed design where the depth to rockhead increases but may not be viable due to the nature of the ground. Insufficient bearing capacity or uneconomical pile no.s
### Route 3: Structures located between the Runcorn Expressway and Spike Island, passing to the east of the Rhodia plant.

<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Advantages</th>
<th>Significance of any glacial material within the river is likely to be granular, which would offer limited advantages in terms of protection to aquifer, insufficient bearing capacity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIUMSPAN</td>
<td></td>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td>Four towers, two in the River and 2 on the saltmarsh. Viaduct across marshes.</td>
<td>Optimum foundation design possible bearing on bedrock.</td>
<td>Temporary works, access constraints for plant, materials and equipment</td>
</tr>
<tr>
<td>TWOSPAN</td>
<td></td>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td>Three towers, one central tower in River and towers to each saltmarsh area.</td>
<td>Temporary works for pier locations in River is reduced. Foundation on rock – significant piled foundation or caisson alternatives to be examined.</td>
<td>Economics of three towers compared to four? Reduced temporary works/piled foundations etc trade off with more significant structures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>May provide a solution to span across Bowers Business Park where contamination is present. The increased strength of rock compared to superficial deposits facilitate larger spans with less significant impact on foundation requirements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Piles to shallow bedrock in the south. North: engineering works largely at grade and likely conventional earthworks requirements. Reduced loads of accommodation structures: piles unlikely to be required in the north.</td>
</tr>
</tbody>
</table>

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Gifford and Partners  
Report No. B423702
14.4 Route 3A

14.4.1 Highways Alignment Description

The proposed alignment will form a dual 2 lane all-purpose standard road link with hardshoulders, D2AP, between the existing Central / Bridgewater/Daresbury Expressway junction in Runcorn and Ditton Roundabout in Widnes. A new D2AP link is also proposed to form a link between the new crossing and the A557 Widnes Eastern bypass via a new grade separated roundabout interchange sited to the West of the Rhodia works.

In Runcorn the new link, will tie-in directly with the Central Expressway. The existing Central Expressway will be made continuous with the new link, crossing the Daresbury Expressway on a new high-level flyover. Connection between Central, Bridgewater and Daresbury Expressways will be via a new roundabout that will be constructed at middle level with the Daresbury Expressway passing beneath at a lower level.

14.4.2 Structure - Main Spans

a) Option 1: Short Span

Details of the short span option are given on drawing B4027/2/B/351.

This option will provide a continuous viaduct across the estuary with spans of around 100m. Construction details will be the same as for Route 2 Short Spans.

b) Option 2: Medium Span

Details of the medium span option are given on drawings B4027/2/B/361 and 362.

This option will provide a series of three cable stay spans each 360m in length with back spans at each end of 180m. Other details will be the same as Route 2 Medium Spans.

14.4.3 Structure - Approach Spans.

The approach spans for each option will be the same type of construction as the short span option, thus providing a continuous viaduct in each case.

Span lengths will be chosen to suit the tie in with the main river structure, the ship canal crossing and the position of the structures at the interchanges at each end of the crossing.

There be two piers at each support location. These will be octagonal in section to match those in the river channel.
14.4.4 Other Structures

a) Central Expressway Interchange

South of the river the layout of the structures at the Central Expressway Interchange will be the same as for Route 3.

A summary of the new structures required together with their approximate length is given in Table 14.7.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Expressway Flyover</td>
<td>Viaduct</td>
<td>185</td>
<td>Crosses existing dual carriageway and roundabout at high level</td>
</tr>
<tr>
<td>Daresbury Expressway Crossing East</td>
<td>Bridge</td>
<td>45</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Daresbury Expressway Crossing West</td>
<td>Bridge</td>
<td>45</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Bridgewater Canal Crossing East</td>
<td>Bridge</td>
<td>40</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Bridgewater Canal Crossing West</td>
<td>Bridge</td>
<td>40</td>
<td>Crosses existing dual carriageway at middle level</td>
</tr>
<tr>
<td>Central Expressway South Approach East</td>
<td>Retaining Wall</td>
<td>75</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>Central Expressway South Approach West</td>
<td>Retaining Wall</td>
<td>70</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>Central Expressway North Approach East</td>
<td>Retaining Wall</td>
<td>55</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>Central Expressway North Approach West</td>
<td>Retaining Wall</td>
<td>45</td>
<td>Retaining wall up to 9m approximate height</td>
</tr>
<tr>
<td>Canal Side</td>
<td>Retaining Wall</td>
<td>60</td>
<td>Retaining wall constant 9m height</td>
</tr>
<tr>
<td>Daresbury Expressway West bound off slip</td>
<td>Retaining Wall</td>
<td>50</td>
<td>Retaining wall 6 to 8m approximate height</td>
</tr>
<tr>
<td>Daresbury Expressway West bound on slip</td>
<td>Retaining Wall</td>
<td>25</td>
<td>Retaining wall 6 to 8m approximate height</td>
</tr>
</tbody>
</table>

Table 14.7 Approach Structures at Central Expressway Interchange

b) Rhodia Interchange and the Speke Road Link

An approximate layout of the necessary structures at these links is shown on drawing B4027/2/B/507.

North of the river the new road stops short of the St Helens Canal. A new structure is required across the canal to carry the main road and slip roads. This structure will comprise precast concrete beams built into the abutments. The road then continues on embankment before crossing the Rhodia Interchange on a new flyover and joining to the Speke Road Link along the same line as for Route 2. The new flyover will be constructed using either in situ concrete or precast concrete beams and will be built in at the piers and abutments.
A summary of the new structures required together with their approximate length is given in Table 14.8.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Structure</th>
<th>Approximate Length (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Helens Canal Crossing</td>
<td>Bridge</td>
<td>35</td>
<td>Carries main road and slip roads over canal</td>
</tr>
<tr>
<td>Rhodia Interchange Flyover</td>
<td>Bridge</td>
<td>110</td>
<td>Crosses new roundabout</td>
</tr>
<tr>
<td>Victoria Road</td>
<td>Bridge</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Railway Tunnel</td>
<td>Bridge</td>
<td>15</td>
<td>Approximately 185m long “pseudo” tunnel</td>
</tr>
<tr>
<td>Speke Roundabout</td>
<td>Bridge</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Railway Wall South</td>
<td>Retaining Wall</td>
<td>30</td>
<td>Retaining wall up to 6m approximate height</td>
</tr>
<tr>
<td>Railway Wall North</td>
<td>Retaining Wall</td>
<td>35</td>
<td>Retaining wall up to 6m approximate height</td>
</tr>
</tbody>
</table>

Table 14.8  Approach Structures at Rhodia Interchange and Speke Road Link

14.4.5 Foundations

Route 3A: Structures located between the Runcorn Expressway and Spike Island, passing from the southern landfall of Route 3 to the northern landfall of Route 2, west of Rhodia. Similar foundation proposals and implications as per Routes 2 and 3.

Generalised Ground Conditions:
Rockhead levels are essentially similar to those reported for Routes 2 and 3. From shallow bedrock at the Manchester Ship Canal the rock level decreases beneath Wigg Island and the Astmoor Salt Marsh to a level of ~5 to ~10m OD across the estuary. Approaching Spike Island the bedrock is observed to deepen to approximately ~30m OD in the vicinity of the St Helens Canal. The deeper rockhead under the northern riverbank has implications for foundation options and design.

<table>
<thead>
<tr>
<th>Form of Structure</th>
<th>Bridge</th>
<th>Advantage/Disadvantage</th>
<th>Foundations bearing on Rock</th>
<th>Foundations bearing in Superficial Deposits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHORT SPAN Viaduct ~ 100m spans</td>
<td>Advantages</td>
<td>Piled foundations to rockhead will be appropriate. Pile length will increase once the northern landfall is reached at Spike Island with time/cost implications</td>
<td>Pile capacities in the drift deposits may not be viable due to the nature of the ground conditions</td>
<td>Cohesive drift would offer some protection to the underlying aquifer.</td>
<td></td>
</tr>
<tr>
<td>Disadvantages Variable rockhead levels indicated across the estuary. Increased costs and time implications due to decreasing rockhead beyond the north River bank.</td>
<td>Insufficient bearing capacity in the drift deposits. May be viable where rockhead at significant depth.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIUM SPAN Four towers; Two in River, two on the saltmarshes</td>
<td>Advantages</td>
<td>Piled foundations to rockhead appropriate. Pile length/foundation depths will increase once the northern landfall is reached at Spike Island with time/cost implications</td>
<td>N/A: Significant imposed loads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantages Temporary works, access constraints for plant, materials and equipment</td>
<td>Unlikely to achieve required bearing capacity or pile capacities for significant tower loads</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Route 3A: Structures located between the Runcorn Expressway and Spike Island, passing from the southern landfall of Route 3 to the northern landfall of Route 2, west of Rhoda. Similar foundation proposals and implications as per Routes 2 and 3.

#### APPROACH

<table>
<thead>
<tr>
<th>North: Embankments and bridge structure over canal</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Piles to rock in the south to the Runcorn Expressway.</td>
<td>- Load carrying capacity for engineering works and structures (possibly not required for current proposals)</td>
<td>- The area within Bowers Business Park has been graded to contain ground and groundwater contamination. Piling to rock may cause potential pathways to form into aquifer. Piling operations/constraints. Geology shows that the depth to rockhead increases towards the north of the project area. Longer piles would be required to reach rock, which may not prove cost-effective.</td>
</tr>
<tr>
<td>- May need to increase diameter of piles to counter the decrease in depth. This may have a cost implication in terms of no. of piles then required.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Issues of sufficient bearing capacity for piled foundations to the structures.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>South: Elevated viaduct off the Expressway.</th>
<th>Embankments proposed to north: conventional earthworks with largely imported fill on areas of weak founding strata</th>
</tr>
</thead>
</table>

#### ACCOMMODATION STRUCTURES

<table>
<thead>
<tr>
<th>Over bridges to the St Helens canal and Victoria Road</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Piles to shallow bedrock where required in the south.</td>
<td>- Glacial material is abundant, predominantly cohesive, which maintains aquifer protection.</td>
<td></td>
</tr>
<tr>
<td>- North: engineering works largely at grade and likely conventional earthworks requirements. Reduced loads of accommodation structures: piles to rock unlikely to be required in the north.</td>
<td>- Most likely cost effective for proposed foundation loads. If piles required to structures then unlikely to need to reach the bedrock.</td>
<td></td>
</tr>
</tbody>
</table>

| Embankment considerations in terms of imported fill, settlements/stability etc on poor ground conditions, may require additional ground treatment or engineering. Ecological impacts of embankment construction. | |

| Increased use of embankment would mean greater land take. | |
15. CONSTRUCTION METHODS

Details of possible construction methods to be employed on the scheme are given in Technical Report No B4027/TR18/01.

16. TRANSPORT ECONOMIC APPRAISAL

Details of the transport economic appraisal carried out for the scheme are given in Technical Report No B4027/TR25/01.

17. ENVIRONMENTAL IMPACT ASSESSMENT

The progress of the Environmental Impact Assessment carried out to date is discussed in Gifford Report No B4027/EIA/03 – EIA Progress Report. The conclusions form this report are as follows:

The findings of the EIA to date can be summarised as follows:

- Route 1 has the greatest negative environmental impact. In particular its impact on the community and the landscape could be considered to be unacceptable.
- Route 4 has the least negative environmental impact in terms.
- Of the remaining alternatives, there is little to choose between Routes 2, 3 and 3A in terms of the environmental impact provided that the number of piers in the river is limited to 2 or 3.

18. FUNDING

Briefing papers on alternative forms of funding have been prepared by KPMG and these are included in Technical Report No B4027/TR20/01 – Funding Options. In addition, the suitability of the scheme for PFI funding is discussed in the Major Scheme Appraisal Report No B4027/MSA/01.

19. EDUCATION LINKS

Gifford have been working closely with Andy Page, Manager of Halton’s Education Business Partnership, to develop teaching materials for schools and colleges in Halton related to the new Mersey Crossing project. The potential of this material for educational use has been recognised by the CITB who are providing some funding towards this venture.

A professional development day for teachers from Halton was hosted by Gifford during the summer 2002 holiday to discuss the types of material that could be used and a teacher’s information pack is being put together which includes laminated images, information on people working on the project and data from traffic assessments and questionnaires.

The two initiatives that are currently being developed are a Key Stage 2 bridge building exercise and a Key Stage 3 public inquiry exercise. Further professional development days have been planned for 2003 to develop these initiatives.
20. HEALTH AND SAFETY

20.1 Design

Health and Safety issues will be addressed during the design process. In particular, the use of hazardous materials will be avoided and construction issues affecting worker safety and ease of maintenance will be considered. A Health and Safety File will be established.

20.2 Construction

Health and Safety issues associated with the construction of the scheme are detailed in Technical Report No 54027/TR18/01.

21. ENVIRONMENTAL MANAGEMENT PLAN

21.1 Purpose of the Environmental Management Plan

The Environmental Management Plan (EMP) describes the management systems and monitoring and auditing arrangements required to ensure the proper implementation of agreed mitigation measures and the verification of predicted environmental impacts for the proposed New Mersey Crossing development.

The overall purpose of the EMP is to enhance the effectiveness of the Environmental Impact Assessment process by providing a systematic and explicit approach for the specification, approval and implementation of environmental mitigation measures.

The EMP will be issued in four parts to cover the various stages of the project:

Part 1 - Investigations and Surveys
Part 2 - Design
Part 3 - Construction
Part 4 - Operation

Gifford Report No B4027/EMP/01 comprising Part 1 of the EMP covered the investigations and surveys carried out for the New Mersey Crossing.

The requirements for preparation and management of the EMP during design phase of project need to be defined once a preferred route has been chosen.

21.2 Implementation of the EMP

Halton Borough Council, in their role as developer for the project, are responsible for the implementation of the EMP. However, at this stage in the project the responsibility for the EMP has been delegated to Gifford who will act as Environmental Manager on behalf of Halton BC.
22. STATUTORY PROCEDURES

As a result of the changes to the method of procurement for the scheme, discussed in section 3, some of the advice given in the Report of Works 1, relating to a tolled scheme, is no longer appropriate. At present it is still unclear which is the most appropriate procedure for the new Mersey crossing and further advice is being sought by Halton Borough Council.

This section contains advice on orders and a public inquiry from the Report of Works 1 which is still appropriate and contains an advice note produced by Persona Associates outlining the requirements for assessing the environmental impact of new projects authorised by orders under Part I of the Transport and Works Act 1992 (TWA).

Halton BC, as the local Highway Authority, can obtain the necessary powers to construct the New Mersey Crossing by making appropriate Orders. The statutory procedures necessary to have the Orders confirmed are likely to be a critical activity in the programme for the project, particularly if there are objections to the scheme. In this case, the Secretary of State would probably ask for a local Public Inquiry to be held.

22.1 Orders

22.1.1 Side Road Orders

Changes to side roads will be enabled through the preparation of side road orders detailing rights of way to be stopped and the new arrangements to be made. Such orders will be required whether the scheme is to be progressed under the Highways Act or the Transport and Works Act.

22.1.2 Orders for Constructing a Bridge over Navigable Waters

An Order under Section 106 of the Highways Act 1980 is required for the construction of a bridge over navigable waters. Similarly an Order would be required where side roads or private means of access cross a navigable waterway. Orders can also be made for the diversion of parts of navigable waters if necessary.

22.1.3 Orders for the Acquisition of Land

A Highway Authority may acquire, by compulsory purchase if necessary, land required for the construction of a highway maintainable at the public expense by an Order under Section 239 of the Highways Act 1980 and for the mitigation of the adverse effects of the new road under Section 246. Other Orders may be required as follows:

- for the acquisition of land which is the property of a local authority or statutory undertaker;
- for the acquisition of land to exchange for certain categories of land acquired for the new road;
- for the provision of facilities for highway users;
• for the acquisition and creation of rights;
• for the construction of buildings to discharge the functions of a Highway Authority; and
• for the diversion of parts of navigable waterways.

A Highway Authority may, subject to certain conditions, acquire land, by compulsory purchase if necessary, in advance of requirements. The need, or otherwise, for this will only become evident as development of the scheme progresses.

22.2 Public Inquiry

The consultation process, carried out thoroughly and in a meaningful and sensitive way, will lead to proposals that will find the widest possible acceptance and therefore minimise most concerns. However, it is more than likely that objections may still be made to any of the above Orders. If any objection is received from a local authority or any person deemed to be affected by the proposal and the objection is not withdrawn, then consideration will be given by the Secretary of State to holding a local Public Inquiry.

22.2.1 Likely Objections

As a result of the consultations carried out to date a number of issues have been raised which could result in objections to one or several of the route options being proposed.

Route 1

There are likely to be a significant number of objections from residents living in Runcorn Old Town and West Bank who are concerned about the disruption during construction and the effects on the community of demolition of properties and community facilities.

There are also likely to be a significant number of objections from other residents and businesses of Halton who are concerned about the effect on the road network during construction.

Network Rail have indicated that they would object to this route as they feel that there would be too much disruption to the rail network.

English Heritage are considered likely to have concerns about the single span option as the proposed cable stayed structure is considered to have a negative impact on the setting of the Silver Jubilee Bridge (Grade II listed structure).

The Mersey Conservator has concerns about the effect of the construction of bridge piers on the hydrodynamics of the estuary.
Route 2

English Nature have concerns over the effect of construction of these routes on the saltmarshes and intertidal habitats which could impact on the bird life, although this route is considered by them to be better than Routes 3 and 3A.

There may be some objections to this route from businesses directly affected but it is considered that these can be overcome by arranging appropriate relocation and/or compensation packages.

The Mersey Conservator has concerns about the effect of the construction of bridge piers on the hydrodynamics of the estuary.

SCARS are likely to object to this route as headroom over the Sankey canal is restricted.

Fidlers Ferry Sailing Club are likely to object to this route as it results in the greatest restrictions to headroom over the River Mersey.

Routes 3 and 3A

There are likely to be objections from residents living in the vicinity of the southern junction with the Central Expressway who are concerned with visual impact, noise and air quality.

There may be some objections to this route from businesses directly affected but it is considered that these can be overcome by arranging appropriate relocation and/or compensation packages.

English Nature have concerns over the effect of construction of these routes on the saltmarshes and intertidal habitats which could impact on the bird life.

The Mersey Conservator has concerns about the effect of the construction of bridge piers on the hydrodynamics of the estuary.

22.2.2 Procedure for Public Inquiry

Public Inquiries can be expensive and time consuming, and as much as 12 months can elapse between the holding of an Inquiry and the receipt of the Secretary of State’s decision. It is therefore considered appropriate to run all the necessary statutory procedures concurrently so that all the objections can be dealt with by a single Public Inquiry. The procedure is normally as follows:

i. Halton BC will publish a notice in the London Gazette and at least one local newspaper stating the general effect of the proposals and naming the place or places where the plans and details can be inspected. The notice will also state to whom and by when objections or representations should be sent. There will be a minimum of six weeks objection period after publication.
ii. One day before the above notice is published, Halton BC will serve a copy on every council within whose area the proposals are located and every authority having jurisdiction over the waters affected by the proposals.

iii. On receipt of the objections and representations, the Secretary of State will request responses from Halton BC to all the issues raised. To avoid unnecessary delay, arrangements will commence for the holding of the local Public Inquiry as it may be some time before the appointed inspector becomes available.

iv. Together with officers of the Council, Gifford will meet with objectors to discuss their concerns and to find ways, acceptable to both parties, that could lead to the objections being withdrawn. If the objections are not withdrawn, the Public Inquiry will proceed.

v. Gifford will provide all the necessary support for the Inquiry in terms of rebuttal evidence, examination of alternatives and export witnesses as required. During the course of the Inquiry, Gifford staff will be on hand to provide information, advice and guidance.

vi. On receipt of the Inspector’s Report, the Secretary of State may confirm the Orders either without modification or subject to modifications as he or she sees fit. (The Secretary of State may confirm only part of the Order, the remainder becoming a separate scheme). The Secretary of State will notify all persons affected by any significant modifications to the proposals and invite them to make representations before confirming the Orders. A Special Parliamentary Procedure may be necessary before certain Orders can be confirmed.

vii. Within six weeks of an Order being confirmed a person may make application to the High Court challenging the Order. It is normally considered prudent to take no steps to implement Orders until after the expiry of this period.

22.3 Advice Note on Transport and Works Act 1992, Environmental Impact Assessment

22.3.1 Introduction

This paper has been produced by Personna Associates and outlines the requirements for assessing the environmental impact of new projects to be authorised by orders under Part I of the Transport and Works Act 19921 (TWA).

Requirements for Environmental Impact Assessment (EIA) of new projects fall under European Community Directives. EIA Directive 97/11/EC introduced important amendments to the previous EIA Directive 85/337/EEC. Parts of these EIA Directives have been implemented by Statutory Instrument (SI)2 amending the TWA, although most of the EIA requirements have been implemented by the

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1 1992 Chapter 42
Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 20003. (These Rules - "the 2000 Rules" - also made amendments other than EIA procedural amendments.)

22.3.2 Environmental Impact Assessment (EIA)

The requirements of the EIA Directive 85/337/EEC, as amended by Directive 97/11/EC, have been applied to applications for TWA orders, partly through the 2000 Rules and partly by the Regulations referred to above. Under the 2000 Rules, all applications for TWA orders that would authorise a project of a type listed in Annex I or Annex II to the Directive must include an environmental statement (ES), except in certain cases of an Annex II project. The only exception would be an Annex II project which the Secretary of State had determined previously, by means of a "screening decision", was unlikely to have significant environmental effects and that therefore an EIA was not necessary.

Before applying for a TWA Order, a prospective applicant should establish whether the proposals comprise an Annex I or an Annex II project. If it is clear that the proposals are covered by Annex I, or are an Annex II project likely to have significant environmental effects, an ES should be prepared. There would be no point in applying for a screening decision.

If, however, the applicant considers that the proposals constitute an Annex II project without significant environmental effects, or it appears to be marginal, a screening decision can be sought from the Secretary of State. The screening decision given by the Secretary of State would then determine whether or not an ES should be prepared.

If the proposals do not constitute an Annex I or Annex II project, there is no statutory requirement for an ES. However, the desirability of providing voluntarily a written appraisal of the likely environment effects should be considered, especially if it is thought that the proposals might have a significant impact on the environment.

An opinion may be sought from the Secretary of State as to what matters should be included in the ES. This is referred to in the 2000 Rules as a 'scoping opinion', as the Secretary of State would in effect determine the scope of the ES. A request for a scoping opinion can be made at any time prior to the making of a TWA order application. (If a prospective applicant intends to request a screening decision, and would also like a scoping opinion if an ES were to be required, a scoping opinion should be sought at the same time.)

22.3.3 Environmental Statement (ES)

Where an ES is or may be required, the applicant may, under rule 6 of the 2000 Rules, serve a notice on the local planning authority, English Nature, the Countryside Agency, the Environment Agency and any person listed in Schedule 2 to the Rules (e.g. in Wales, the Nature Conservancy for Wales), requesting any
environmental information they hold that is relevant to the preparation of the ES (or relevant to the preparation of an application for any screening decision).

Rules 7 and 9 of the 2000 Rules require an applicant to submit with the application "the applicant's statement of environmental information". Although this is defined in the Rules as a statement submitted by an applicant as an ES in relation to the application, it gives the flexibility to cover the possibility that what an applicant initially submits with the application as an ES might not actually meet the statutory requirements. What the applicant submits as an ES only becomes such once all the statutory requirements have been met.

22.3.4 Environmental Statement (ES) – Content

Information to be included in an ES under rule 11 of, and Schedule 1 to, the 2000 Rules, must include:

A description of the project comprising information on the site, design and size of the proposed works (see also para. 4.2 item 6 below).

A description of the measures proposed to be taken in order to avoid, reduce and, if possible, remedy any significant adverse effects on the environment of the proposed works.

The data required to identify and assess the main effects which the proposed works are likely to have on the environment.

An outline of the main alternatives to the proposed works studied by the applicant and an indication of the main reasons for his choice, taking into account the environmental effects.

A non-technical summary of the information provided under paragraphs 1 to 4 above.

The ES must also include so much of the information specified below as is relevant to the proposed works (subject to any scoping opinion given by the Secretary of State). [Note: Items highlighted below in grey would appear NOT to apply to New Mersey Crossing]

A description of the project, including in particular:

a description of the physical characteristics of all of the works covered by the application and the land-use requirements during the construction and operational phases;

a description of the main characteristics of the production processes, for instance, the nature and quantity of the materials used;

an estimate, by type and quality, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation and any others) resulting from the operation of the project.
A description of the aspects of the environment likely to be significantly affected by the project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets (including the architectural and archaeological heritage), landscape and the inter-relationship between the above factors.

A description of the likely significant effects of the project on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project, resulting from:

- the existence of the project,
- the use of natural resources, and
- the emission of pollutants, the creation of nuisances and the elimination of waste,
- and the description by the applicant of the forecasting methods used to assess the effects on the environment.

A non-technical summary of the information provided under paragraphs 6 to 8 above.

An indication of any difficulties encountered by the developer in compiling the required information.

22.3.5 Conclusion

The EC Directive requirements outlined in this paper for assessing environmental impacts related to TWA order projects, apply equally to other infrastructure projects. For example, the Directive, in relation to highway projects to be authorised under Highways Act 1980 orders, have been implemented by different SIs to TWA orders. These SIs, all entitled "The Highways (Assessment of Environmental Effects) Regulations" are those made in the years 1988 (SI 1988/1241); 1994 (SI 1994/1002); and 1999 (SI 1999/369).

The requirements, however, of the environmental information to be supplied - the Environmental Statement - is effectively the same for projects authorised under other Acts of Parliament as those for TWA projects.

23. FURTHER WORKS

The further work required to progress the scheme is detailed in the Major Scheme Appraisal Report No B4027/MSA/01 and the Technical Reports (listed in the foreword to this report).
NEW MERSEY CROSSING

REPORT OF WORKS 2 VOLUME 2

HIGHWAYS AND STRUCTURES DRAWINGS
NEW MERSEY CROSSING
REPORT OF WORKS 2 VOLUME 2
HIGHWAYS AND STRUCTURES DRAWINGS

CONTROLLED DOCUMENT

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</tr>
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<td>Checked:</td>
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<td>Ian Hunt</td>
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Revision Record

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NEW MERSEY CROSSING
REPORT OF WORKS 2 VOLUME 2
HIGHWAYS AND STRUCTURES DRAWINGS

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