

THE MERSEY GATEWAY PROJECT

ALTERNATIVES

CHAPTER 5.0

THE MERSEY GATEWAY PROJECT

ALTERNATIVES

CONTENTS

5.	ALTERNATIVES.....	5.4
5.1	Introduction	5.4
5.2	Proposed Second Runcorn-Widnes Bridge – Initial Feasibility Report	5.6
5.3	Department of Transport Studies.....	5.6
5.4	Mersey Crossing Group Studies.....	5.12
5.5	Second Mersey Crossing at Runcorn – Review of Options.....	5.17
5.6	Mersey Crossing Study – Integrated Transport Solutions	5.19
5.7	Major Scheme Appraisal Alternatives.....	5.24
5.8	Fixed Route Alternatives – to the East of the SJB.....	5.35
5.9	The Project – Design Alternatives	5.49
5.10	Construction Alternatives.....	5.59
5.11	Summary.....	5.65
5.12	References.....	5.67

FIGURES

Figure 5.1	Timeline for Development of Alternatives
Figure 5.2	Department of Transport Alternatives
Figure 5.3	Option One: Speke to Hooton
Figure 5.4	Option Two: M57 to A562 Link Road to Frodsham
Figure 5.5	Option Three: A562 Link Road to Runcorn West
Figure 5.6	Option Five: Runcorn to Widnes Bridge
Figure 5.7	Option Six: Widnes Eastern Bypass – Runcorn
Figure 5.8	Mersey Crossing Group Study Alternatives
Figure 5.9	Horizontal Alignment Options
Figure 5.10	Tin In / Landing Point Locations
Figure 5.11	Preferred Eastern Option (Central Expressway to East of Albright & Wilson)
Figure 5.12	Consideration of Alternatives
Figure 5.13	Tunnel Options
Figure 5.14	Alternative Fixed Routes
Figure 5.15	Demolition of Properties Required for Route 1
Figure 5.16	Regeneration and Development in Widnes
Figure 5.17	Regeneration and Development in Runcorn
Figure 5.18	Areas of Contamination
Figure 5.19	Route Four Alternatives
Figure 5.20	Short Span Pier Arrangement
Figure 5.21	Medium Span Four Tower and Pier Arrangement

Figure 5.22	Medium Span Four Tower and Pier Arrangement (revised)
Figure 5.23	Medium Span Three Tower and Pier Arrangement
Figure 5.24	Medium Span Three Tower and Pier Arrangement (revised)
Figure 5.25	Construction Option – Island Method

5. ALTERNATIVES

5.1 Introduction

- 5.1.1 Schedule 4 of the 1999 Regulations sets out the information that should be included in an ES. Paragraph 2 of Part 1 states that an ES should include “*an outline of the main alternatives studied by the applicant and an indication of the main reasons for his choice, taking into account the environmental effects*”.
- 5.1.2 The following section of the ES provides an outline of the main alternatives studied and reasons for choices in influencing their de-selection.
- 5.1.3 As noted in Chapter 1 a number of problems in Halton are caused by the existing access constraints across the SJB and the resulting negative effects on accessibility, social deprivation and economics. A summary of these issues is provided in Table 5.1 below.

Table 5.1 - Summary of Current Issues within Halton

Issue	Description
Accessibility	High demand for cross River trips through Halton compared with the available crossing capacity provided on the SJB (design capacity is currently 65,000 vpd, however flows regularly exceed 80,000 vpd).
	Unreliable public transport and road traffic service due to the frequent delays and disruption on the SJB.
	Perceived and actual dangers associated with cross River pedestrian and cycle access (Section 4.5).
Socio-economic	Deprivation within Halton (more details are provided at Chapter 4 and 20 of this ES)
	Regeneration being constrained by access. The inability of the local highway and public transport networks to perform reliably is affecting economic development and investment in Halton.
Network Resilience	The SJB is a source of network weakness – it has a considerable on-going maintenance programme to ensure that it can remain operational and its peak-hour capacity has been exceeded with resultant peak spreading. The M56 to the south of the Borough links West Cheshire and North Wales with Manchester. The M62 to the north links Merseyside to Manchester and to Yorkshire. The M53 to the west links North Wales and Cheshire to the Wirral and Liverpool City Centre via the Mersey Tunnels. The M6 to the east is the main arterial route between the north-west region and the rest of the country. The SJB, lying centrally on the A553, linking the M56 and the M62 is a key component of the strategic highway network. Whilst not part of the trunk road network it serves to provide a degree of network resilience when other Mersey Crossings experience incidents and has local and regional significance but is not, in itself, resilient.

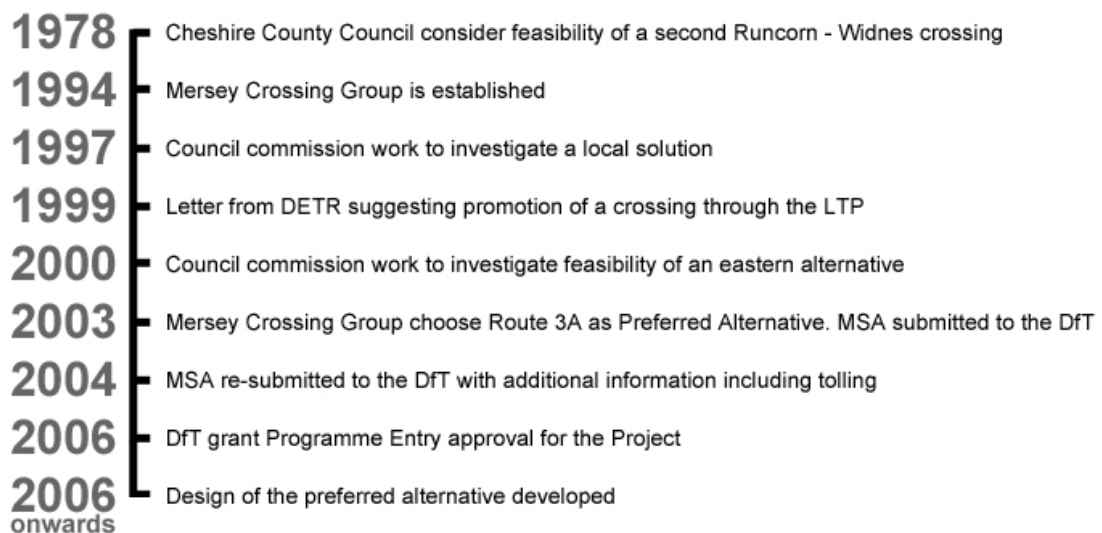
- 5.1.4 A number of studies exploring potential alternatives to solve those problems outlined in Table 5.1 have been explored in detail since 1978, as listed in Table 5.2 and Figure 5.1.

Table 5.2 - Historic Feasibility Studies

Study Title	Date	Client	Consultant
Proposed Second Runcorn-Widnes Bridge – Initial Feasibility Report	Feb '78	Cheshire County Council	Mott, Hay Anderson
Mersey Crossing Study Survey Report	Apr '92	Department of Transport	Transport Planning Associates

Study Title	Date	Client	Consultant
Mersey Crossing Study – Final Summary Report	Sep '93	Department of Transport	Oscar Faber TPA
Mersey Crossing Study – Stage 1 Report	Jun '97	Mersey Crossing Group	Oscar Faber TPA
Stage 2 Environmental Assessment for New Mersey Crossing	Mar '98	Mersey Crossing Group	RPS (for Oscar Faber)
Economic Impact of Second Runcorn Bridge	Sep '98	Mersey Crossing Group	Liverpool Macroeconomic Research
New Mersey Crossing Study – Stage 2 Report	Mar '99	Mersey Crossing Group	Oscar Faber
Second Mersey Crossing at Runcorn – Review of Options	Jun '99	Halton Borough Council	Mott MacDonald
Mersey Crossing Study – Integrated Transport Solution Volumes One, Two and Three	May '00	Mersey Crossing Group	W S Atkins
Mersey Crossing	Sep '00	Halton Borough Council	KPMG
Major Scheme Appraisal	Jul 2001	Halton Borough Council	Gifford
Major Scheme Appraisal	Nov 2004	Halton Borough Council	Gifford

Figure 5.1 – Timeline for development of Alternatives



5.1.5 Alternatives studied within the reports listed in Table 5.2 are discussed below, together with a summary of the reasons why they were not selected.

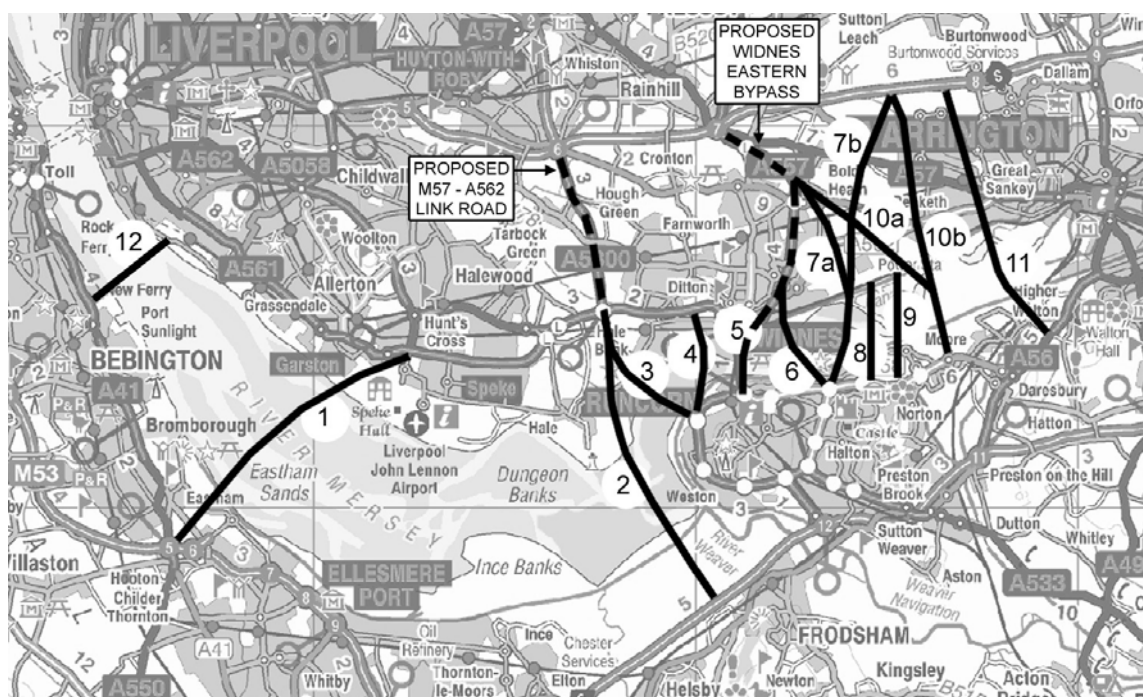
5.2 Proposed Second Runcorn-Widnes Bridge – Initial Feasibility Report

- 5.2.1 As table 5.2 demonstrates, solutions to reduce traffic congestion across the River have been under consideration since 1978 when Cheshire County Council commissioned a survey to determine the feasibility for a second crossing of the River. The alignment considered by Cheshire County Council at this time was for new a crossing to be constructed between the SJB and railway bridges. At the time it was concluded that a bridge alongside the existing structure in the Runcorn Gap was feasible. However, for the purposes of the Project the principle of a second crossing was established, albeit that other alternatives were subsequently re-examined as set out below.

5.3 Department of Transport Studies

- 5.3.1 In 1991 The Department of Transport (DOT) undertook the Mersey Crossing Study (see Table 5.2) to identify whether, and if so where, there was a need to provide additional strategic highway capacity across the River to the west of the M6 (DOT, 1992 and 1993). A Planning Proposal and Constraints Map was produced to identify the major engineering, planning and environmental features in the area and served as a basis for the development and assessment of 12 possible route options (as shown on Figure 5.2).

Figure 5.2 - Department for Transport Alternatives (1991)



- 5.3.2 These options were subjected to a preliminary traffic, environmental, engineering and economic assessment in order to eliminate those options which would not be feasible. Five options (as shown on Figures 5.3 to 5.7 below) were considered feasible and were therefore investigated in more detail, with a rigorous consideration of the geological, engineering, environmental, traffic and economic factors as discussed below. These five options were:

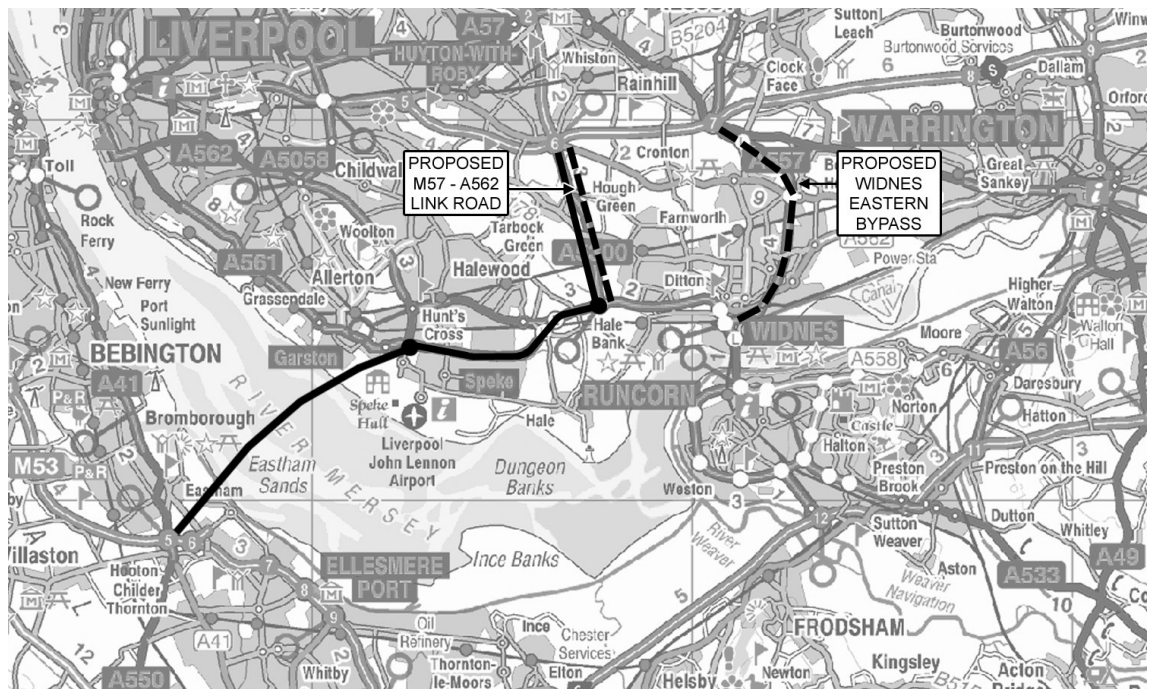
- Option One: Speke to Hooton;
- Option Two: M57 to A562 Link Road to Frodsham;
- Option Three: M57 to A562 Link Road to Runcorn West;
- Option Five: Runcorn to Widnes Bridge; and
- Option Six: Widnes Eastern Bypass to Runcorn.

5.3.3 Other options were not considered further.

Option One: Speke to Hooton

5.3.4 Option one (Figure 5.3) comprised a new 4.9km low level bridge rising to a high level to cross the Manchester Ship Canal, crossing between Speke and Hooton, requiring an upgrade to the existing roads and junctions and provision of new junctions which would provide access to the bridge.

Figure 5.3 - Option One: Speke to Hooton



5.3.5 Environmental mitigation measures were considered to be required to minimise the effect on the ecology of the River. These were considered to be expensive and probably difficult to implement.

5.3.6 This new crossing was considered to attract a large amount of relatively short distance, local traffic, which would otherwise use the Mersey Tunnels. Traffic flows and hence toll revenue in the tunnels was estimated to be approximately halved. This option was considered to be of limited significance as a strategic route and would not attract sufficient traffic from the SJB to overcome the predicted problems of traffic congestion here. As a result option one was not considered to be a satisfactory solution for either local or strategic traffic.

5.3.7 This option would cross the River at its widest part, where it was predicted to have a substantial negative effect on the Estuary's flow regime and wildlife passing through what is now the Mersey Estuary Site of Special Scientific Interest (SSSI), Special Protection Area (SPA), Ramsar and European Marine Site (at the time the SPA, Ramsar and European Marine sites were proposed for designation). It was also considered to have a major visual effect.

5.3.8 It was however considered that this crossing would produce substantial travel distance savings and time savings, particularly for the large volumes of local traffic between Ellesmere Port and Liverpool and some Wirral to Liverpool traffic, which in 1993 travelled out of its way via the Mersey Tunnels. Thus although this option was not considered to solve the major problems of

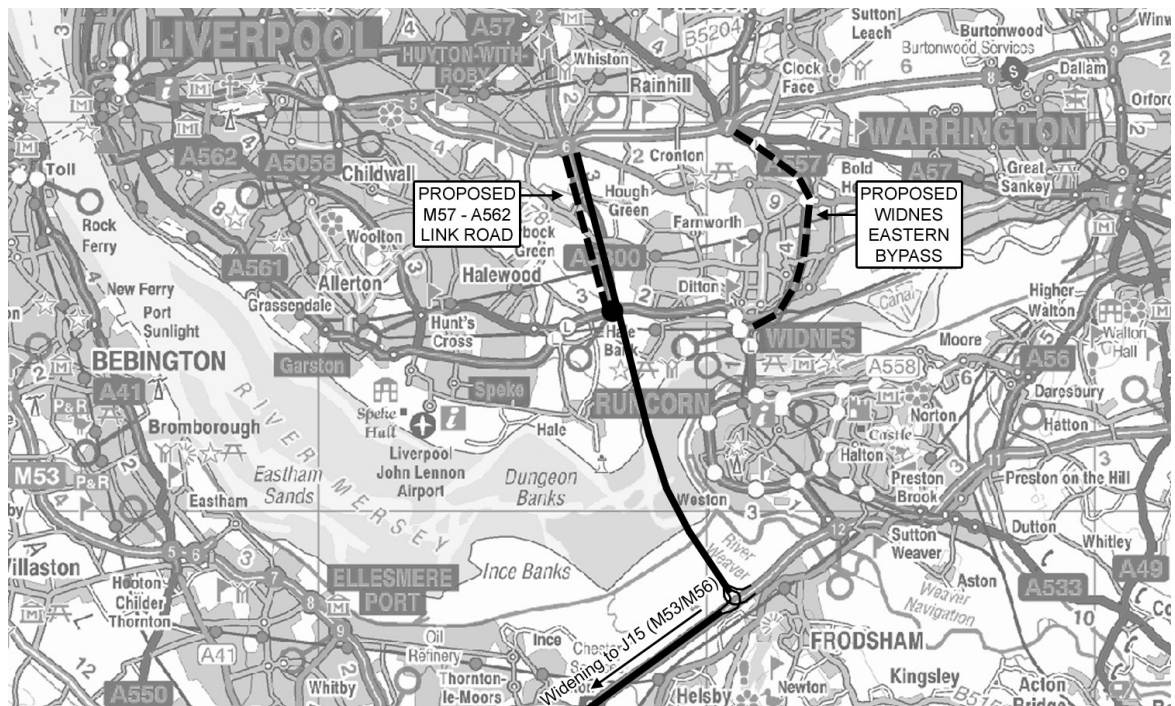
inadequate capacity at the SJB, it was considered to have the potential to produce large economic benefits.

- 5.3.9 It was considered that option one would reduce the need for the widening of the M56 which was proposed at the time of the assessment.
- 5.3.10 Option one could improve access to Liverpool Airport and could therefore assist in its future development and expansions. However, it would not be ideally located for this.
- 5.3.11 Tolls on option one were investigated as part of this study. This indicated that should it be tolled, traffic demand on this new crossing would reduce by up to 60%, but if the SJB were also to be tolled it would become financially viable.

Option Two: M57 to A562 Link Road to Frodsham

- 5.3.12 Option two (Figure 5.4) would comprise a new 5.3km low-level crossing on an extended M70-A562 link road to connect directly with the M56, rising to cross the Manchester Ship Canal at high level. It would require the upgrading of existing roads and junctions and the provision of new junctions to provide access to the new crossing, along with widening of the M56 between Junction 15 and the new crossing.

Figure 5.4 - Option Two: M57 to A562 Link Road to Frodsham



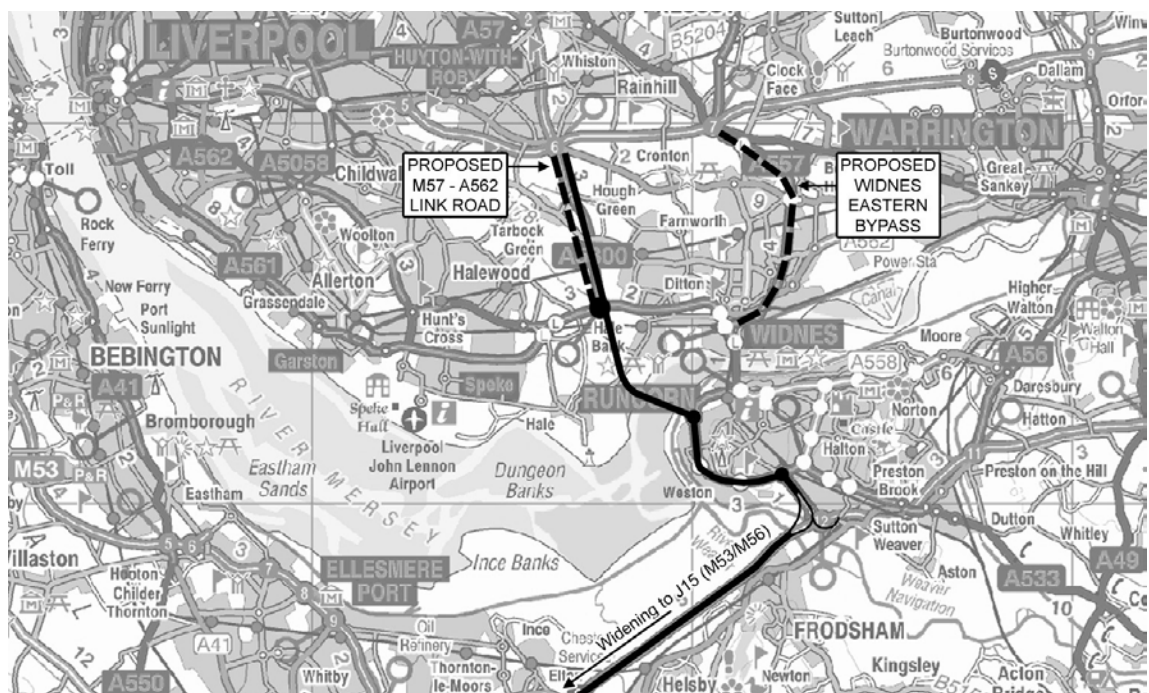
- 5.3.13 It was considered that environmental mitigation measures to minimise the effect on the ecology of the River would be expensive and probably difficult to implement.
- 5.3.14 It was anticipated that this option would provide a good quality, direct connection between the M56 and M62, which would attract long distance strategic traffic. It was considered that this option would provide good relief to the SJB so that by 2016 conditions would be similar to those in 1993. With its direct connections to the motorway network it was envisaged that it would segregate strategic and local traffic movements and would be the ideal location for a new River crossing. It was also concluded that option two would provide good access to Liverpool Airport.

- 5.3.15 Option two was considered to have substantial negative effects on the River's flow regime and the wildlife of the Estuary (passing through the SSSI and, at the time, the proposed SPA, and Ramsar site). It was also anticipated that this option would have a major visual effect on ecology and the rural environment.
- 5.3.16 The 1993 study indicated that option two would produce substantial travel savings for travellers and so, despite its high cost, would be economically worthwhile. It was considered that option two would be viable for private funding if tolls were permitted on both the new crossing and the SJB.

Option Three: M57 to A562 Link Road to Runcorn West

- 5.3.17 Option three (Figure 5.5) consisted of a new crossing from the M57 to A562 Link Road to Runcorn West requiring upgrading of existing roads and junctions, provisions of new junctions which would provide access to the new bridge and widening of the M56 (J12 to J15).

Figure 5.5 - Option Three: A562 Link Road to Runcorn West



- 5.3.18 It was estimated that environmental mitigation measures required to minimise effects on the ecology of the River would be expensive and probably difficult to implement.
- 5.3.19 It was considered that this option would provide good relief to the SJB but would attract less traffic than other options considered. The Runcorn Expressway section would be operating close to capacity and would continue to carry a significant proportion of local traffic. Consequently speeds and travelling conditions were considered to be less than ideal. The study indicated that engineering constraints would make it difficult to provide access from northern parts of Runcorn and consequently movements to the SJB would be slightly restricted so that by 2016 conditions would be worse than those predicted in 1993.
- 5.3.20 Similarly, to options one and two, option three would pass over the designations within the Estuary. However, the effect on the wildlife and environment of the Estuary was anticipated to be less severe than the other options due to its short span. The studies also indicated that

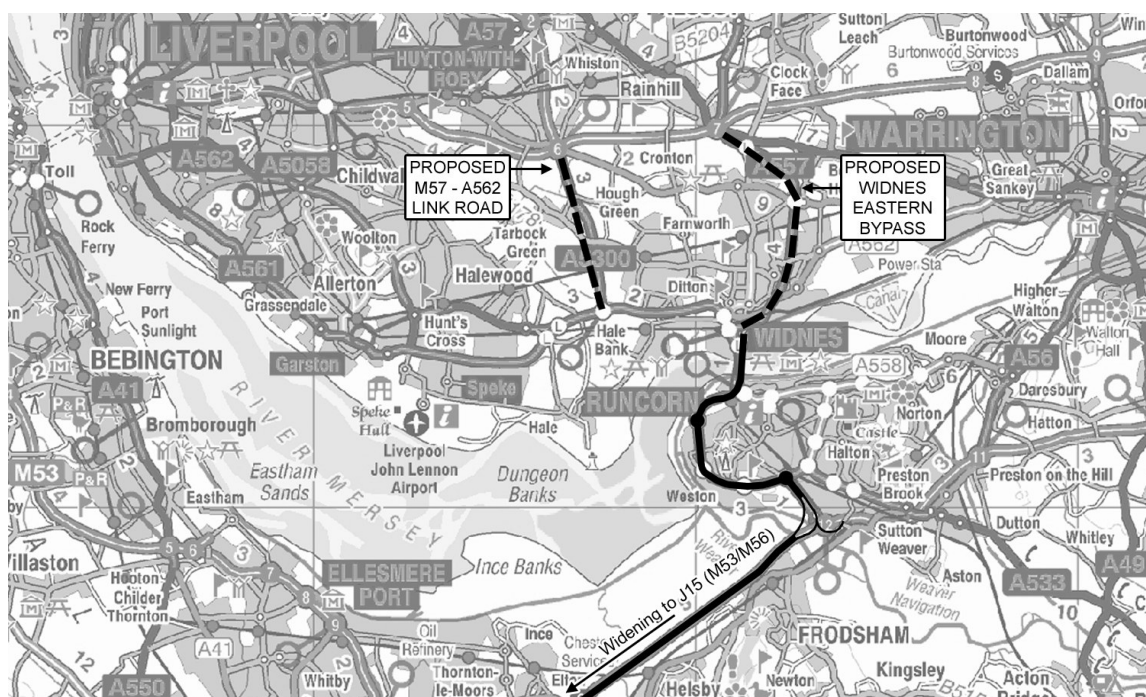
increased traffic flows and up-graded roads and junctions would increase traffic nuisance in some urban parts of Runcorn.

- 5.3.21 As with other options it was considered that, in order to be successful as a private sector tolled crossing, this option would need to be tolled in combination with the SJB.

Option Five: Runcorn to Widnes Bridge

- 5.3.22 Option five (Figure 5.6) would comprise a crossing parallel and adjacent to the SJB providing a total of four lanes in each direction with associated improvements to the existing roads and junctions and widening of the M56 (Junction 12 to 15).

Figure 5.6 - Option Five: Runcorn to Widnes Bridge

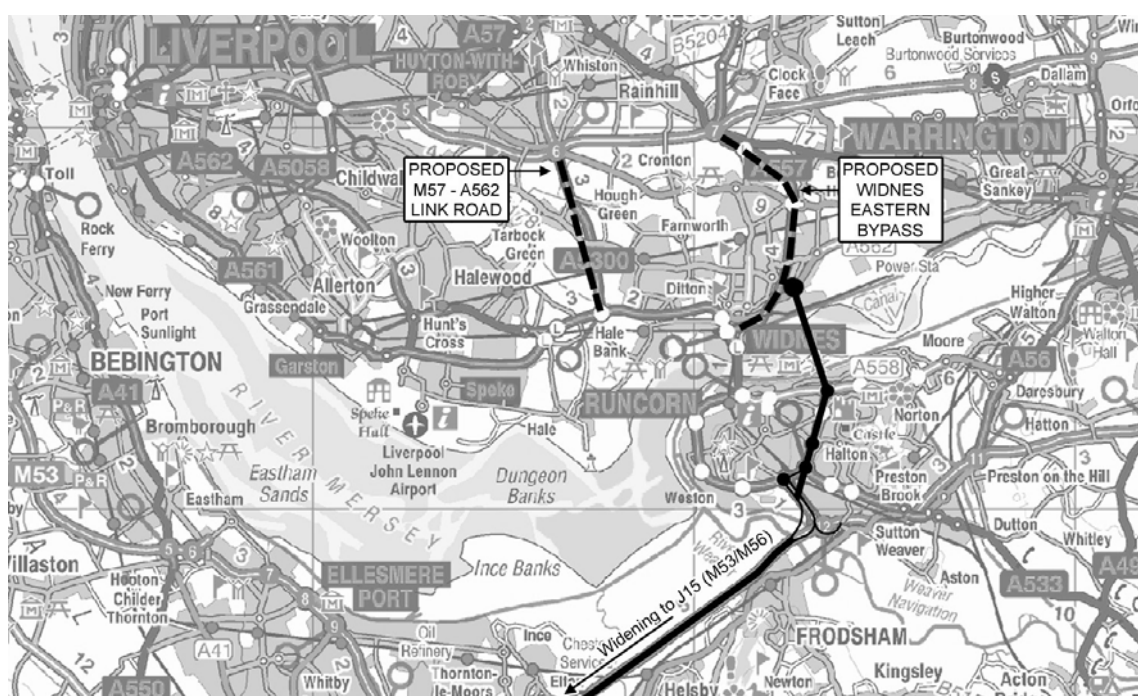


- 5.3.23 The study suggested that this option would ease congestion on the SJB so that 2016 levels would be similar or only marginally worse than levels predicted for 1993.
- 5.3.24 It was considered that this option would have a relatively neutral effect on wildlife and the rural environment. The main effects would be experienced by residents of Runcorn living close to the bridge who would be affected by increased noise and air pollution.
- 5.3.25 It was anticipated that this option could be financially viable as a privately financed toll operated bridge with the tolling of the existing SJB.

Option Six: Widnes Eastern Bypass – Runcorn

- 5.3.26 Option six (Figure 5.7) would comprise a 2.6km crossing from the Widnes Eastern Bypass to the A558/A538 Runcorn Central and Eastern Expressways with upgrades to the existing roads and junctions and widening of the M56 (Junction 12 to 15).

Figure 5.7 - Option Six: Widnes Eastern Bypass – Runcorn



- 5.3.27 The 1993 study indicated that this option would attract a significant proportion of local traffic, providing relief to the SJB, but that it would place considerable stress on the Runcorn Eastern and Central Expressways. It was considered that the suitability of option six as a strategic route would be severely limited by its need to use the Central Expressway, which the study considered to be primarily a town centre distributor road.
- 5.3.28 Option six would be located on a relatively narrow, stable part of the River and its effect on the designated sites and the wildlife and environment of the River would be substantially less than options one, two or three. It was anticipated that the greatest effect of this option would be on the industrial and residential areas of Runcorn through increased noise levels, disturbance and demolition.
- 5.3.29 Due to its location close to the SJB it was considered that option six would only be viable if the SJB was also tolled.

Study Findings – Comparison of Options

- 5.3.30 Option two was considered to be the preferred option as it would provide good relief to the SJB and economic benefits. It would however require the crossing of designated sites and created other environmental problems at Frodsham Marshes.
- 5.3.31 Option three was considered to be second choice. Option five was third choice, should difficulties of constructing a bridge across the ecological designations be experienced.

Department of Transport Decision

- 5.3.32 In a letter dated 28th July 1994 the DOT ruled out these strategic options for a new crossing on environmental grounds which were considered to out-weigh economic benefits and subsequently a crossing, promoted on a national level by the DOT was not considered viable.

5.4 Mersey Crossing Group Studies

5.4.1 Following the DOT's decision in July 1994 the Council took on the task to solve congestion issues associated with the sub-standard SJB crossing at a local level. As noted in Chapter 2 (Section 2.1) the Mersey Crossing Group was established in 1994, comprising local and regional stakeholders. Following ministerial approval in December 1995, the Mersey Crossing Group commissioned investigations into the feasibility of a new crossing within the vicinity of the SJB. This consideration of alternatives formed a different exercise to the consideration of strategic alternative crossings, as set out above, notwithstanding that the Project considered and promoted by the Council will have important strategic aspects. The objectives of this study were as listed below:

- a. To examine the feasibility of a new local crossing aimed at relieving the SJB, in order to remove constraints on accessibility across the River; and
- b. To facilitate future developments in the widest area on both the north and south banks.

5.4.2 The study area extended to approximately 3km either side of the SJB encompassing both possible extensions of the A5300 in the west, and possible crossings linking to the Runcorn Expressway near Astmoor in the east, as the nearest practical options to the SJB but facilitating alternatives of the existing highway network.

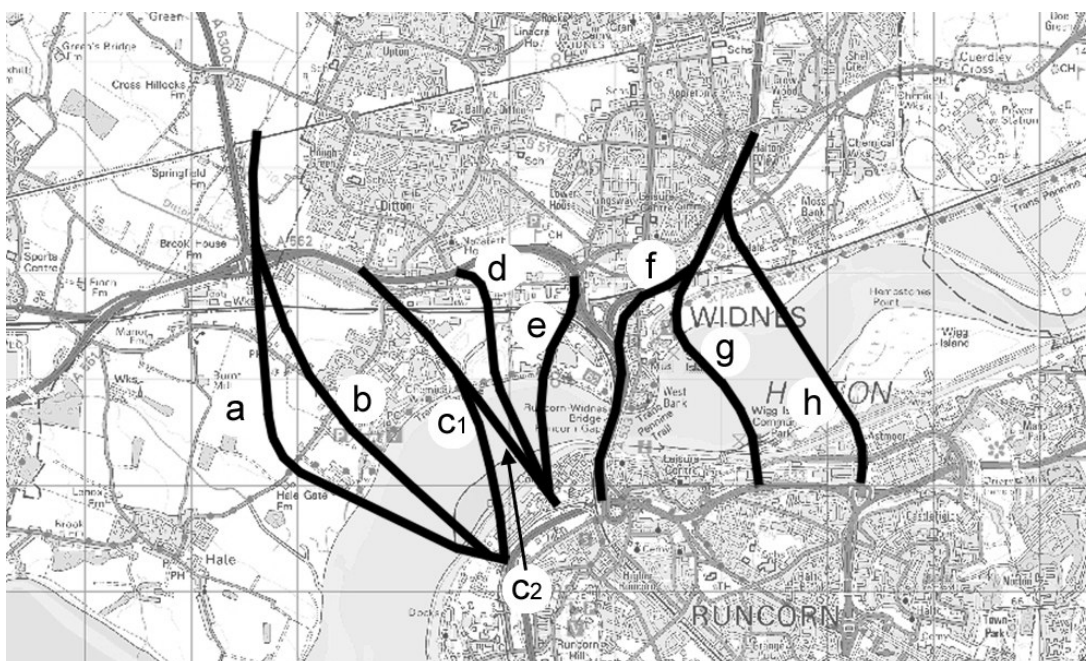
5.4.3 The study was undertaken in two stages between 1997 and 1999. Stage 1 (1997) involved the identification and assessment of a wide range of alternatives within the 3km corridor either side of the SJB. The preferred alternatives were then subject to a preliminary assessment of their traffic, economic development, environmental and engineering effects. Three options were then taken through to the Stage 2 analysis (1999), which involved an assessment of alternatives. The following sections provide a summary of both the Stage 1 and Stage 2 assessments.

Stage 1 Assessment of Alternatives for Mersey Crossing Group

5.4.4 A tunnel was discounted at the onset of the Stage 1 assessment due to environmental constraints. Ground conditions, comprising mainly superficial drift material, were considered to make conventional tunnelling unsuitable and it was predicted that the Manchester Ship Canal would present an obstruction which may prevent use of the immersed tube technique. In addition, immersed tubes would have a significant effect on the River bed and therefore an adverse environmental effect. It was also considered that the connection of a tunnel to the existing highway network would prove difficult and expensive. For these reasons a tunnel was discounted from this study.

5.4.5 Nine alternatives were considered in the Stage 1 assessment as shown on Figure 5.8 and discussed below.

Figure 5.8 – Mersey Crossing Group Alternatives



Option A: A5300 to A557 Weston Point Expressway

- 5.4.6 This alternative links the southern terminal of the A5300 to the A557 Weston Point Expressway north of the chemical works with all movement junctions at the terminal points of the new crossing. The study indicated that avoidance of works within the Estuary could not be achieved with this alternative, or routes to the south of this line, by a suspension bridge as the towers would extend above the 'approach surface' of Liverpool John Lennon Airport's runway. At the time of this study, the Airport noted that all structures must be less than 130m above ground level to safeguard this approach surface.

Option B: A5300 50 A557 Weston Point Expressway

- 5.4.7 This is a shorter variation than Option A having the same terminal arrangements but having a greater effect on residential areas to the north of the River.

Option C1 and C2: A562 Speke Road near Everite Road to A557 Weston Point Expressway

- 5.4.8 Options C1 and C2 leave Speke Road in the vicinity of Everite Road, climbing over Hale Road and the railway and following Ditton Brook on viaduct to the River. It was envisaged that the new route would become the through road and that slip roads would be provided to link to the existing Speke Road. The separation of the A5300 slip roads and this proposed junction were considered to be substandard.
- 5.4.9 On approaching the River, the two options diverge, C1 taking a more southerly route, crossing the dock area and joining the line of the Runcorn Expressway to the north of existing Picow Farm Road junction, but being some distance above it. At the time of the study this was considered to be a very difficult terminal point, the railway being higher than the Expressway. It was therefore considered that this route would be on viaduct to the north of the River.
- 5.4.10 Option C2 takes a shorter line across the River joining the Expressway north of Picow Farm Road Interchange by means of a tight curve. The route then crosses the railway and drops down to join the Expressway with the existing road split sideways to maintain links to the east.

Option D: A562 at St Michael's Road to A577 Weston Point Expressway

- 5.4.11 Option D leaves the A562 by means of two slip roads in the vicinity of St Michael's Road, the southbound one sweeping in a tight curve to pass over the A562, across the golf course and Ditton Road, then joining the northbound slip to pass over the railway and a landfill site. South of the River the connection is as described above for option C2.

Option E: A562 at Queensway to A557 to Weston Point Expressway

- 5.4.12 Option E leaves the A562 at its junction with Ditton Road, one junction option then sweeps through the route over the roundabout and the first railway, before passing through two of the arches carrying the Runcorn to Liverpool railway adjacent to Desoto Road East. It would then regain height to follow the line of and above Desoto Road East on viaduct then across the River to terminate on the Expressway as described for option C2.

Option F: A second bridge adjacent to the SJB

- 5.4.13 Option F comprises a second bridge between the SJB and the railway bridge at the same level. The realignment that would be required at the northern approach to tie in with the existing highway network would appear to be relatively straightforward but would be subject to a thorough examination at Stage 2.
- 5.4.14 The study noted that the connection of a new crossing to the Runcorn Expressway could be made by means of improvements to the existing slip roads to the SJB or by a complete re-design of the junction with revised priorities. Stage 1 of this assessment concluded that should this alternative be taken forward to Stage 2, a full assessment would be required of the two alternatives.

Option G: A557 Widnes Eastern Bypass to A533 Daresbury Expressway at Astmoor Road (West)

- 5.4.15 Option G leaves the Widnes Eastern Bypass as it passes under the railway at Appleton Street. The new route would become the through route as it climbs to pass over the St Helens Canal enabling the west bound slip road from the eastern bypass to pass under it. This study indicated that any junction proposed on this trunk road would require Highways Agency approval.
- 5.4.16 The route for this option would then skirt Spike Island then cross the River to terminate at an elevated roundabout above the Daresbury Expressway, where Astmoor Road currently passes under it. Full slip road connections could be provided but Astmoor Road could no longer join the Expressway at this point, a new western connection for Astmoor Road would have to be provided, possibly to Birdge Street or Heath Road.

Option H: A557 Widnes Eastern Bypass to A533 Daresbury Expressway at the Central Expressway Junction

- 5.4.17 This option leaves the Widnes Eastern Bypass north of Appleton Street, crossing the Railway, St Helens Canal, the River and the Manchester Ship Canal. The study indicated that any junction between this option and the Widnes Eastern Bypass would require approval from the Highways Agency.

- 5.4.18 South of the River this option would cut through the Astmoor Estate to join the expressway at the junction between the Daresbury and Central Expressways. Both this and the northern junction were tested to allow for all movements.

Study Findings – Comparison of Options

- 5.4.19 The western options (A, B, C1, C2, D and E) were considered to provide the best solution in terms of segregating sub-regional and local traffic and providing significant relief to the SJB. It was also considered that they would improve accessibility to Liverpool John Lennon Airport. It was however considered that these options would be expensive due to the road works required. A western crossing would also pass through the nature conservation designated sites and it was concluded that it may prove difficult and expensive to establish an environmentally sensitive solution in this location.
- 5.4.20 The on-line option (F) was considered to be the cheapest crossing option and provide an achievable solution. This option was predicted to cause minimal environmental disruption on the downstream designated sites. However, due to its proximity to urban the areas of Widnes and Runcorn, it was however considered to have a detrimental effect on people, homes and existing development in the immediate vicinity of the crossing. In addition it was considered that Option F would not naturally segregate sub-regional and local traffic and therefore require complex traffic management works to achieve this.
- 5.4.21 Eastern options (G and H) were considered to assist development in Knowsley, St Helens and particularly in Halton. A crossing to the east of the SJB was considered to provide significant local development opportunities by providing access to developable land. It was also considered that a crossing to the east would provide relief to the SJB. Negative effects were anticipated to be associated with work that would be required on the existing trunk road network to segregate local and strategic traffic. In addition, it was considered that the presence of piers within the Estuary would have the potential to mobilise river bed contaminants which may adversely affect the downstream designated sites (SSSI, SAP and Ramsar).
- 5.4.22 This study concluded that, given the nature of the work to date and the environmental sensitivity associated with some of the options, a range of options should be taken forward to the Stage 2 assessment. These were an on-line, western and eastern option. Those alternatives taken forward to the Stage 2 assessments included options A, B, F and G. All other alternatives were not taken forward for further consideration.

Stage 2 Assessment of Alternatives for Mersey Crossing Group

- 5.4.23 Additional work was undertaken as part of the more detailed Stage 2 assessments to further investigate the feasibility of options A, B, F and G. This work is listed below:
- a. An economic assessment of possible employment effects of these alternatives and their ability to attract new investment;
 - b. An engineering assessment of each alternative for their alignment within the existing highway network and possible bridge structure;
 - c. An environmental assessment to determine environmental advantages and constraints; and
 - d. Traffic modelling to provide traffic forecasts for each alternative.
- 5.4.24 Additional economic work was also undertaken further to define the economic and employment effects associated with the Stage 1 assessment and potential public transport improvements. This concluded that the ranking of alternatives in Stage 1 remained the same both with and without the consideration of public transport options.

- 5.4.25 The conclusions which were drawn for each alternative following the Stage 2 assessment work are summarised below.

Western Crossing (Options A and B)

- 5.4.26 The Stage 2 work indicated that height restrictions imposed by Liverpool John Lennon Airport on the towers for a crossing in this location would mean that a single span bridge structure would not be an option for crossings to the west of the SJB. The preferred bridge structure for options A and B was therefore considered to be a two span suspension bridge with a central pier in the River. Option B would require a slip road to link with the Expressway which would require a southern pier within the River. Option A would require up to three piers to be located in the River. Both options were considered to have an adverse visual effect on the quality of the area and would cross the designated nature conservation sites of the Mersey Estuary. Placing piers within the River would require detailed analysis in order to determine the effect on the designated sites, which at the time of the study was considered to be unjustified. Options A and B were also considered to have a substantial effect on planning policy designations. In terms of traffic both options would segregate sub-regional and strategic traffic and relieve the SJB. It was however considered that these options would increase traffic flows on the A557.

On-Line Option (Option F)

- 5.4.27 The Stage 2 assessment acknowledged that the gap between the SJB and railway bridge would limit construction of a new crossing at this location, and noted that further assessment would be required regarding the aerodynamics of a new bridge deck in this area. The study concluded that the on-line option would require the demolition of some housing within Runcorn and Widnes. It noted that, due to its location, traffic disruption would be inevitable during the construction phase. The environmental assessment indicated that the SJB and railway bridge, which are both listed, may be affected during the construction and operation of an on-line option. The environmental study noted that siting piers at this location and their effect on the downstream designated nature conservation sites would require further investigation. This option was considered to have minimal effects on planning policy designations. In terms of traffic the study showed that the on-line option would not segregate sub-regional and strategic traffic and it would also increase traffic flows on the Runcorn Expressway and A561 through Widnes.

Eastern Crossing (Option G)

- 5.4.28 The Stage 2 assessment indicated that northern junction works which would be required for this option would be constrained by adjacent industrial plants and the railway. The southern junction would require diversion of Astmoor Road requiring demolition of housing and a school. The engineering assessment estimated that fifteen piers would be located in the River bed, which (it was then predicted) may have negative effects on the downstream designated sites due to potential for mobilisation of contaminants and sediments - then was considered to require further investigation. It was considered unlikely that option G would change the visual quality of the area and have no effect on cultural heritage receptors. The study concluded that there would be a moderate to substantial effect on planning policy designations. In terms of traffic the study considered that this option would not segregate sub-regional and strategic traffic but would relieve the existing SJB. It would however increase traffic flows on the A533.

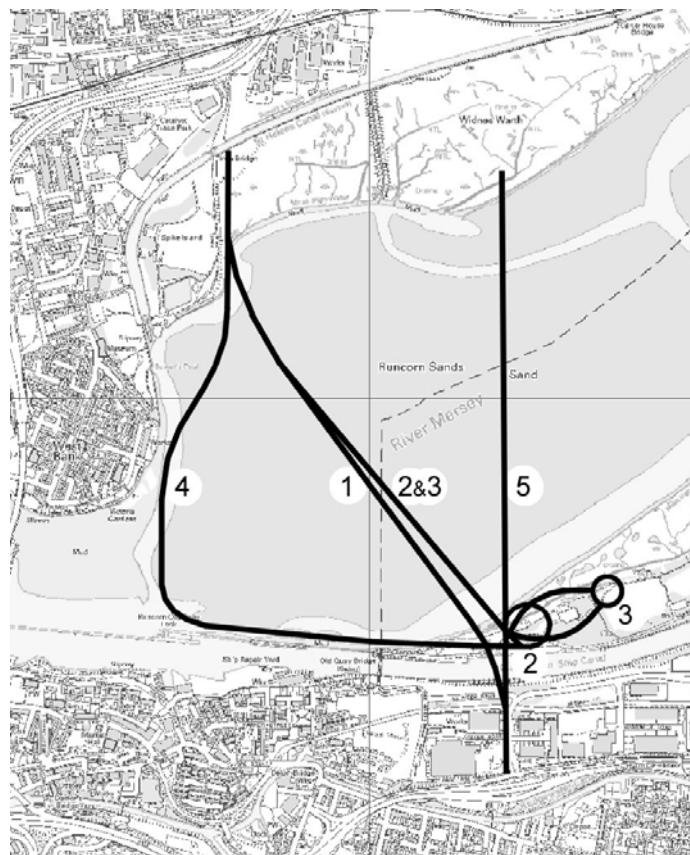
Conclusions

- 5.4.29 In conclusion, the Stage 2 assessment noted that all options would be likely to have environmental effects, in particular on the designated sites. From this perspective options A and B, which are located to the west of the SJB, would have the greatest effect. The eastern option would have less of an effect due to its location outside these designated sites, but this would depend on the final design of the bridge structure and number of piers requires within the River and their location. It was considered that all options would deliver economic benefits. The on-line option was considered to be the cheapest of all routes and produce the highest return in terms of traffic benefits. The resulting reduction in travel times was also considered likely to produce economic benefits.
- 5.4.30 The on-line option was therefore considered by the Stage 2 assessment to be the most cost effective and deliverable alternative and to meet the objectives of the study (paragraph 5.4.1). It was acknowledged that further work would be required to investigate the effect of this option on the designated sites. The Stage 2 study recommended the on-line alternative as the route for a new crossing of the River.

5.5 Second Mersey Crossing at Runcorn – Review of Options

- 5.5.1 A study was commissioned by the Council in 1999 'Second Mersey Crossing at Runcorn – Review of Options' to explore in more detail the feasibility of alternatives to the east of the SJB which were outlined by the Stage 1 and 2 Mersey Crossing Group's assessments.
- 5.5.2 This study examined five options for a crossing to the east of the SJB as shown on Figure 5.9 and discussed below based on which costs were calculated to determine feasibility.

Figure 5.9 – Horizontal Alignment Options



Option 1

- 5.5.3 Three variations of option one were considered, options 1A, 1B and 1C. Each of these is discussed in turn below.
- 5.5.4 From the south, crossing approaches of option 1A would be elevated above the Astmoor Road, crossing above the Manchester Ship Canal at height on a horizontal curve so that the alignment across the River would be substantially perpendicular to its course. The crossing would remain at this elevation until it reached the northern shore and then descend rapidly, resulting in a vertical profile for the road. This alignment was considered to have minimal effects on the River flow due to the presence of few piers in the River. This alternative was also designed to provide sufficient navigational clearance at the Manchester Ship Canal and ensure navigational clearance for the full width of the River itself.
- 5.5.5 Alternatively, option 1B would remain at elevation (32m) across the Manchester Ship Canal and across the southern-most 150m of the River to allow navigation, it would then descend to a level of 12.6m AOD across the rest of the River. This would minimise the length of the structure, but would result in a vertical profile that was not considered to be ideal for the form of bridge construction and realistically to preclude forms such as a cable stayed bridge. However, the study considered that this alignment would be acceptable for viaduct type engineering solutions.
- 5.5.6 Option 1C was designed to embrace a high level crossing of the Manchester Ship Canal at 32m elevation and then immediately descend making no allowance for full height navigation of the River. The study concluded that this option would in reality provide clearance of 13-19m over this portion of the River which would allow navigation. As with option 1B, this vertical alignment would be compatible with a viaduct form of construction but not a long span structure.

Option 2

- 5.5.7 This option crosses the Manchester Ship Canal away from its interchange with the expressway but perpendicular to the canal's axis. Immediately having crossed the canal the road falls east, in a single spiral, onto the ground of the Astmoor saltmarshes. This option would then be perpendicular to the River flow, at 12.6m elevation. It was considered that an advantage of this option would be its crossing of the River at a low level, minimising foundation costs and length of the crossing. It would also produce a vertical profile for the crossing that was suitable for all forms of bridge construction. It does, however, introduce the additional length of the spiral into the crossing. The study also concluded that this option would result in reduced navigation clearances over the River.

Option 3

- 5.5.8 This option is similar to option 2, except that the spiral connecting the crossing of the Manchester Ship Canal and the main crossing is replaced by a gentle sweep down onto Astmoor saltmarshes to a roundabout. This option would allow road access to be provided onto the saltmarshes, potentially facilitating their development.

Option 4

- 5.5.9 This option is similar to option 2 for the portion of crossing over the Manchester Ship Canal and the spiral down onto the saltmarshes. The alignment then proceeds at ground level westwards adjacent to the riverside wall of the Manchester Ship Canal, crossing the River on a relatively short bridge at 12.6m AOD elevation, giving a reduce navigation air clearance over the River.

Option 5

- 5.5.10 This option is a perpendicular crossing of the Manchester Ship Canal. The alignment continues on a straight projection of this bearing across the River to the eastern end of the north shore. This option would be similar in vertical alignment to option 1, and is split into a number of sub-alternatives known as options 5A, 5B and 5C.
- 5.5.11 The study indicated that due to the high level constant vertical profile of this option, a long span bridge could be provided with its back-span abutment located to the south of the Manchester Ship Canal, generating the minimum number of supporting piers. This could minimise impacts on the River flow and therefore reduce environmental effects.

Conclusions

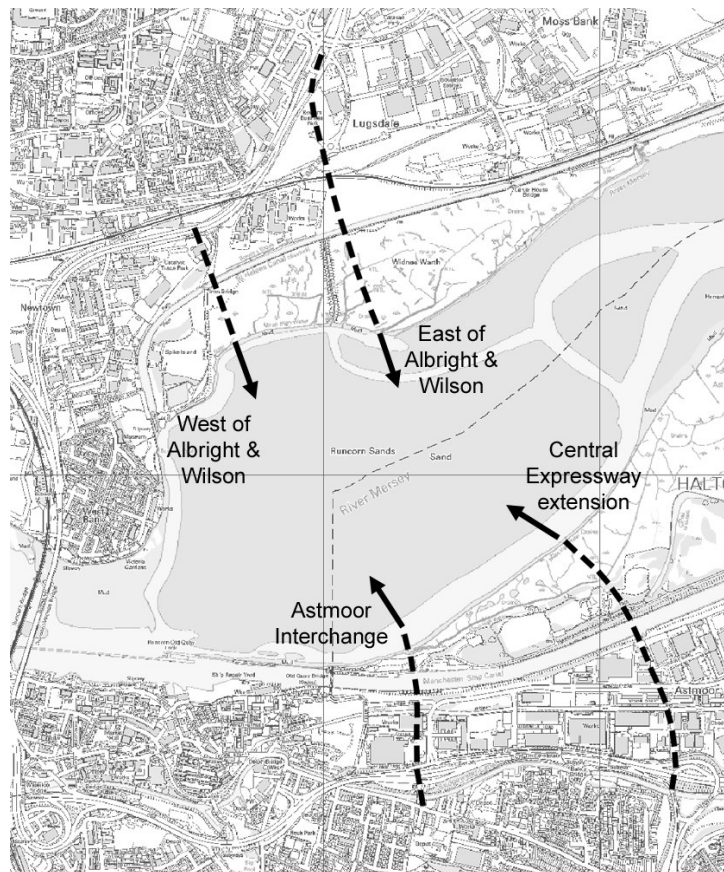
- 5.5.12 This study concluded that a low-level eastern alignment would be feasible. Based on an examination of costs of those alternatives set out above, option 1 was considered to offer the most economic benefits.
- 5.5.13 The conclusions of this study acknowledged that additional work would be required, as listed below, further to progress a scheme to the east of the SJB.
- a. Geotechnical and contamination investigation;
 - b. Analysis of navigation requirements across the River;
 - c. Further develop carriageway requirements;
 - d. Environmental study to determine constraints, especially those associated with the River;
 - e. Establish height limits associated with the operation of Liverpool John Lennon Airport;
 - f. Assess the feasibility and cost benefits of implementing a crossing independently of reclamation which is required on the north shore, constructing the northern approaches either on a causeway or on viaduct;
 - g. Topographical survey; and
 - h. Investigate options for a new interchange with the Daresbury Expressway.

5.6 Mersey Crossing Study – Integrated Transport Solutions

- 5.6.1 A letter from the Department of the Environment, Transport and the Regions (DETR) was issued to the Council on 24th May 1999 which indicated that a scheme to promote a crossing of the Estuary would have to be included and justified within the Regional Transport Strategy and implemented at a local level through the Local Transport Plan (LTP). The DETR emphasised the importance of considering alternative solutions to relieve traffic congestion in Halton.
- 5.6.2 Based on the review of options undertaken in 1999 (Section 5.5), the Council commissioned further work (undertaken in 2000) to determine the effectiveness of a new crossing to the east of the SJB in attracting local traffic (and whether attempting to separate 'local' from 'sub-regional' traffic would be appropriate) and to consider connections to the highway network for all modes of transport. This study also took into account the effect on economic regeneration, environmental, engineering and finance issues.
- 5.6.3 Based on a review of planning policy, economic initiatives, public transport, highway infrastructure, environmental, engineering and physical constraints the study identified four alternatives for a new crossing to the east of the SJB.
- 5.6.4 To the south of the River the study identified two points where a new crossing could tie into the existing Runcorn Expressway highway as listed below:

- a. Connecting to Bridgewater Expressway at the present Astmoor West Interchange; and
 - b. As an extension to the Central Expressway (connecting to the Bridgewater Expressway / Daresbury Expressway / Central Expressway).
- 5.6.5 On the north side of the River, the study initially considered three potential tie-in locations as listed below:
- a. Connecting to Widnes Eastern By-pass south of the Garston to Warrington railway and Ashley Way (West of Albright and Wilson's works);
 - b. Connecting to Widnes Eastern By-pass between Ashley Way and Fiddlers Ferry Road (East of Albright and Wilson's works); and
 - c. Forming an extension to an upgraded Tan House Lane.
- 5.6.6 Following engineering assessments it was concluded that a Tan House Lane termination could not realistically be achieved due to the railway crossings and the need to maintain access to premises and minimise the loss of businesses. This alternative was therefore not considered further.
- 5.6.7 With two potential tie-in locations on each bank, four alternative crossings were developed and analysed as listed below and shown on Figure 5.10:
- a. Astmoor to West of Albright and Wilson;
 - b. Astmoor to East of Albright and Wilson;
 - c. Central Expressway to West of Albright and Wilson; and
 - d. Central Expressway to East of Albright and Wilson.

Figure 5.10 – Tie-in / Landing Point Locations



- 5.6.8 Within each of these four basic concepts the study further developed a number of sub-options in which the form of the terminal junctions varied. The assessment of all alternatives considered links to walking, cycling and bus links within Halton. The following provides a comparison of the four options outlined above against a number of key considerations.

Comparison of Northern Terminations (West and East of Albright and Wilson)

Planning and Economic Development

- 5.6.9 The study concluded that the eastern option was preferred as it directly serves the Tan House Lane industrial area, and it has the potential to skirt (and therefore serve), rather than intrude into, a development opportunity area located at Widnes Warth.

Impact on Property

- 5.6.10 The study concluded that the differences between the schemes were limited. The western option was noted to have some small effect on the western fringe of the Albright and Wilson site and / or the eastern end of the former ICI plant. It was concluded that the eastern option would affect a scrap recycling operation south of the Garston-Warrington railway, and potential development plots at Bowers Business Park.

Traffic Attractiveness

- 5.6.11 The study concluded that the western option would attract about 34,000 vehicles per day (vpd) away from the SJB, while the east of Albright and Wilson alignment could attract 40,000vpd.

Capital Costs

- 5.6.12 The study estimated that that the east of Albright and Wilson alternative would cost more than the western option due to the additional rail crossing required and the greater overall length of this scheme.

Traffic Economics

- 5.6.13 Journey time saving calculations suggested that the east of Albright and Wilson alternative would provide an additional saving and vehicle operating cost reduction when compared with the western option.

Summary

- 5.6.14 Overall the study concluded a preference for an alignment east of Albright and Wilson on the north bank of the River.

Comparison of Southern Terminations

Planning and Economic Development

- 5.6.15 The study indicated a slight preference in favour of a Central Expressway termination, as this more easterly location was considered to provide more direct access to the Manor Park and Daresbury development areas.

Impact on Property

- 5.6.16 The study favoured the Astmoor West tie-in point on property impact grounds as it would affect one large property, which included eight smaller units. The Central Expressway alternative would however affect ten properties including fourteen businesses.

Traffic Attractiveness

- 5.6.17 The study indicated that the Central Expressway alignment would be preferred as the majority of traffic using the bridge would approach and depart via the central expressway and this tie in point was considered to serve the main traffic demand directly. The Astmoor West connection was considered to introduce a 'dog leg' into the route to / from the Central Expressway.

Capital Cost

- 5.6.18 The study indicated that the Central Expressway requires an additional outlay when compared to the Astmoor West alternative, a proportion of which arises from increased land / property costs.

Traffic Economics

- 5.6.19 The study concluded that the Central Expressway alternative would provide an additional time and operating benefit when compared to the Astmoor alternative.

Bus Improvements

- 5.6.20 The Central Expressway crossing was considered to provide a more direct route for bus services between Halton Lea and surrounding residential areas on the south side of the River to Widnes Town centre and suburban areas on the north bank.

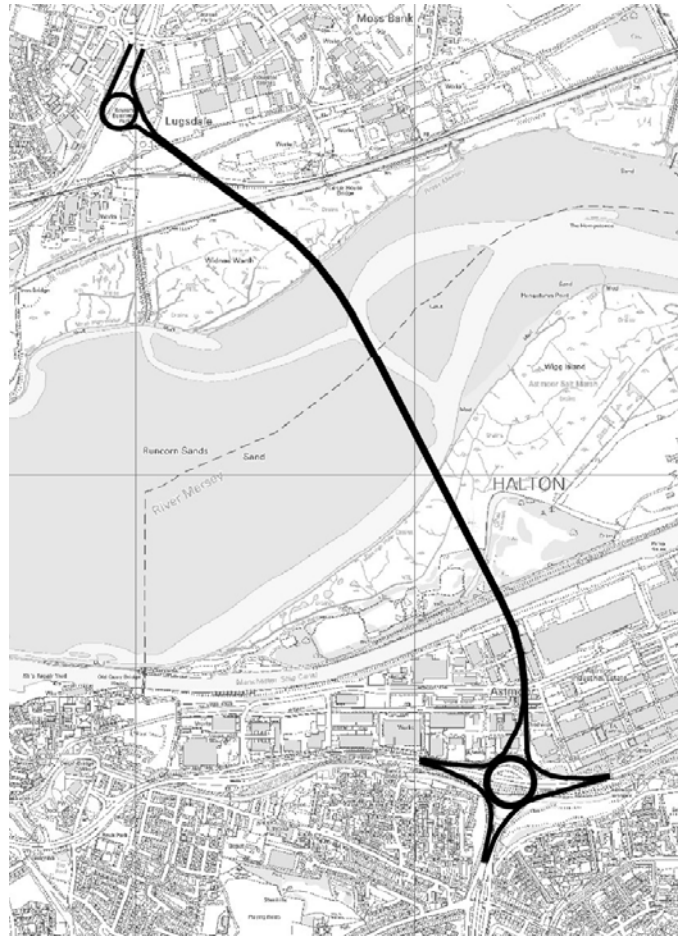
Summary

- 5.6.21 In summary the study concluded that the Central Expressway alternative achieves a better performance but that there would be a significant cost penalty involved.

Conclusions

- 5.6.22 The study also considered a wide range of environmental effects upon which many of those alternatives studied were considered to have similar effects. For example, it was considered that all alternatives have the potential to affect the designated sites downstream of the SJB, navigation and mobilisation of contaminants from River sediments. However, it was not considered possible at the time of this study to assess the degree to which each alternative would have an effect.
- 5.6.23 This study concluded that the best performance would be provided by the Central Expressway alternative to the east of Albright and Wilson as shown in Figure 5.11. However, this alternative had the highest cost and effect on property. The Astmoor to East Albright and Wilson was considered to perform slightly less well but cost less.

**Figure 5.11 – Preferred Eastern Option
(Central Expressway to East of Albright & Wilson)**



- 5.6.24 In order to provide a robust comparison of alternatives this study also compared the preferred eastern alternative with the on-line alternative that was put forward as a result of the Mersey Crossing Group's studies (Section 5.4).
- 5.6.25 The results of this comparison are set out below.
- a. Planning and Economic Development Issues: It was considered that both alternatives types would offer congestion relief. The study concluded that the eastern alternative had the potential to open up more land and be better located to serve Manor Park and Daresbury development areas on the south bank and, south east Widnes on the north bank;
 - b. Ecology: It was considered that the on-line alternative would have less effect on the River and the locally designated habitats within it (refer to Chapter 4 of this ES for more details on ecological designations);
 - c. Pollution: It was considered that the on-line alternative would result in less silt disturbance as the rock head is closer to the surface and the faster River flow means that there is less silt present in this location. In addition, fewer piers would be in place;
 - d. Hydrology / Navigation: It was considered that River flow would be minimised with an on-line alternative as the piers would be constructed in line with those of the railway bridge and navigation rights would be unaffected as this alternative would need to be at the height of the SJB to tie in to existing approach roads;

- e. Noise / Air Quality: It was considered that noise effects would be the same for both alternatives. The study concluded that an eastern alternative would have a marginally better air quality effect than the on-line alternative;
- f. Traffic Economics: It was considered that the on-line alternative would provide less time and operating benefits when compared to the eastern alternative.
- g. Public Transport: It was concluded to be more difficult to achieve as greater improvements for public transport with an on-line alternative;
- h. Walking and Cycling: The study indicated that there was more scope for improving links from West Bank to Runcorn with an on-line alternative, but an eastern alternative would offer more scope for leisure trips;
- i. Impact on Land: It was estimated that the on-line alternative would require demolition of 20 residential properties, with the eastern alternative requiring the loss of 8 residential properties and 14 industrial units;
- j. Construction, Land and Fee costs: It was estimated that the overall cost of constructing the on-line alternative would be less than an eastern alternative; and
- k. Financial Viability: It was concluded that the on-line alternative would be of greater interest to the private sector as toll income would be similar for all options but capital outlay and effects on ecological / river receptors would be less onerous.

5.6.26 Based on this comparison of alternatives it was considered that in addition to the alternative to the east of Albright and Wilson, the on-line and Western alternatives should not be ruled out at this stage of assessment. The study concluded that further work was necessary to provide additional assessment of ground conditions, environmental issues, hydrology and funding.

5.7 Major Scheme Appraisal Alternatives

5.7.1 The work undertaken by and on behalf of the Council between 2001 and 2003 focused on comparing potential detailed alternatives to address problems associated with congestion in Halton and took forward further work specified by preceding studies (paragraph 5.6.26).

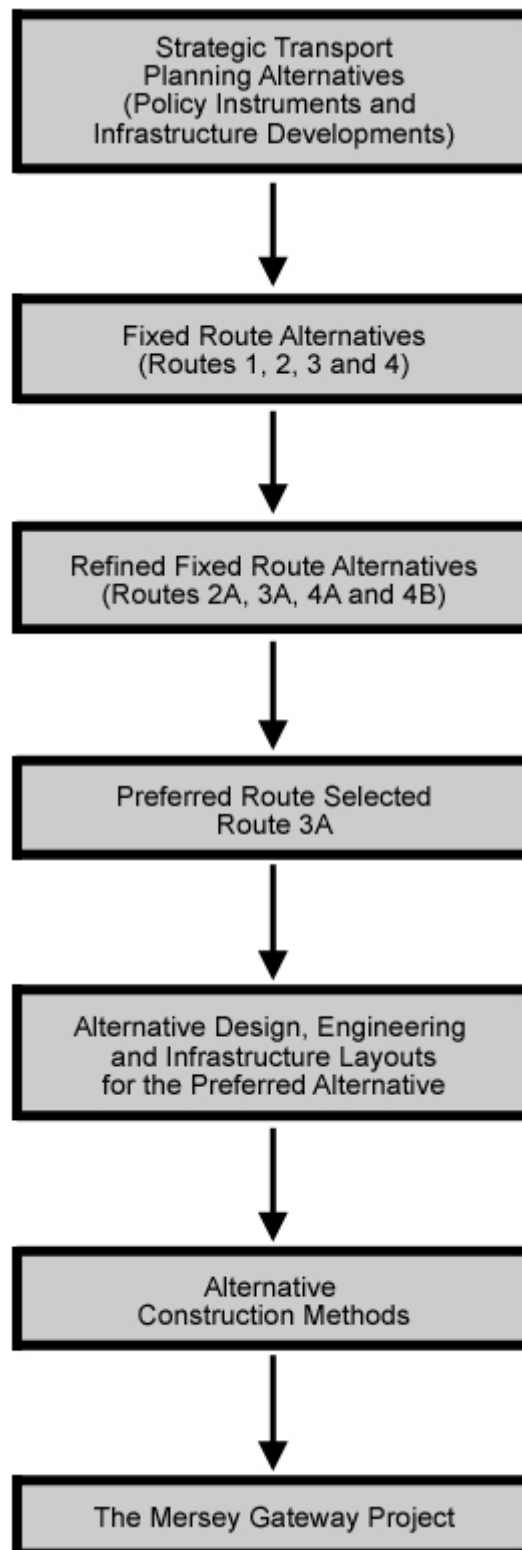
5.7.2 This work was summarised within a document known as a Major Scheme Appraisal ("MSA") which was submitted first to the DfT in 2003 and then resubmitted, accompanied by additional data sought by the DfT in 2004. The work compared alternative options to address those problems listed in Table 5.1 and to achieve a number of regional and local objectives as follows:

- a. To relieve the SJB, thereby removing the constraint on local and regional development and better provide for local traffic;
- b. To maximise development opportunities;
- c. To improve public transport links across the River; and
- d. To encourage the increased use of cycling and walking.

5.7.3 For any scheme to be successful the Council required it to fulfil as many of the above objectives as possible, to fit its environment and to be economically viable.

5.7.4 Throughout the MSA process a range of alternatives were considered through a hierarchical approach as set out below (Figure 5.12). Those alternatives which satisfied the above objectives, fitted their environment and were economically viable were then considered further until a preferred solution was identified.

Figure 5.12 - Consideration of Alternatives



- 5.7.5 This approach began with a comparison of strategic transport planning alternatives (including alternatives other than new road infrastructure) before focusing on fixed route alternatives for a crossing to the east of the SJB. Those fixed route alternatives considered were then further refined in order to maximise the benefits of the final scheme and to fully satisfy the MSA

objectives where possible. The precise design and construction methods for the preferred alternative were also considered in detail until a final scheme was chosen that achieved the MSA objectives, was economically viable and had acceptable environmental effects.

Strategic Transport Planning Alternatives

- 5.7.6 A number of strategic alternatives with the potential to solve congestion problems in Halton (Table 5.1) and achieve the MSA objectives as set out above were considered throughout the development of the Project. It was important to consider such alternatives because they might have offered means of resolving problems caused by the present situation without the expense or environmental impact associated with constructing a new crossing. The strategic alternatives can be broadly split between policy and infrastructure alternatives. The following section provides detail on the high level alternatives that were considered and reasons why they were not taken forward. Each option was analysed and assessed for its feasibility, its impact on the environment and its ability to address the existing accessibility and socio-economic issues within Halton, as set out in Table 5.1.

Policy Instruments

Halton Travel Plan Network

Description

- 5.7.7 The Travel Plan alternative is based upon the principles of destination-led modal choice decision making, where a person's destination (such as their home or workplace) enables initiatives to help encourage modal shift to more sustainable modes and change travel behaviour. Such initiatives include car sharing schemes, provision of cycle facilities, public transport information and support actions to reduce trip demand through home working and remote site access to services.

Discussion

- 5.7.8 The success of travel plans is dependent on the take up of initiatives by individuals concerned, viability of local transport networks to accommodate travel by sustainable modes, and the level of inter-travel plan synergy to realise an area wide travel plan. Evidence suggests that the impact of travel plans tends to be highly localised and that they do not readily achieve a substantive reduction in travel demand for highway trips. It is therefore unlikely that cross borough traffic would be reduced and therefore congestion on the SJB would not be reduced. It is also difficult to impose travel plans, which can be costly to organisations unless they perceive real benefits. Even the adoption of a Halton-wide travel plan would not allow for improvements to the SJB and therefore would not allow the required public transport, cycling and pedestrian improvements for cross river traffic to be delivered.
- 5.7.9 This alternative was therefore discounted as it is unlikely substantially to reduce travel demand and hence relieve congestion on the SJB, it would be difficult to implement a borough wide plan in all organisations and it would not allow for improvements to cycle, pedestrian and public transport routes is unlikely to assist with all journeys across the borough or where such journeys begin or end outside the borough.

Charging for Using Existing Bridge or Other Roads

Description

- 5.7.10 The theory behind pricing as a means to reduce highway vehicle trip demand is that a proportion of users will be deterred from making trips by having to pay a stated level of charge for access to the road network generally or a specific section of the road network.
- 5.7.11 The success of road pricing in managing demand has not been demonstrated conclusively. Whilst it appears that users become increasingly insensitive to pricing, for example increased petrol prices or rail fares have little impact on travel demand. On the other hand, experience in London with the introduction of congestion charging indicated that road user charging had reduced travel demand for trips by private car, although recent evidence suggests that reductions in congestion were short lived.
- 5.7.12 The most straightforward method for charging for the use of highways to reduce congestion would be the provision of barrier tolls. In order to implement this alternative a barrier would need to be placed across the affected route, in this instance the approach roads to the SJB.

Discussion

- 5.7.13 The physical process of collecting payments in itself would impose an additional delay on travellers and further reduce demand. The efficiency with which charges can be collected varies according to the mix of traffic and the method of payment, but a predominately manual system would not typically cater for more than 400 vehicles per hour / per lane. On this basis at least 10 lanes in each direction would be required to service two lanes in each direction across the SJB. Each lane would be at least 5m wide and perhaps 150m long between extended tapers to / from the two running lanes.
- 5.7.14 The SJB and its approaches are generally elevated, barely catering for the main running lanes, and it would not therefore be possible to accommodate tolling facilities on the necessary scale on the immediate bridge approaches. If the tolling facilities were to be located more remotely, additional approaches would then require tolling facilities, and it would become increasingly difficult to maintain independent routes for both crossing and local traffic.
- 5.7.15 In addition, this alternative is unlikely to improve public transport and the provision of pedestrian and cycle facilities in the local area. Even if an alternative to barrier tolling was available and suitable, these aims would not be addressed and other important considerations would be unaffected such as:
- a. Provision of capacity to reduce congestion;
 - b. Robustness of the highway link; and
 - c. Opportunities for maintenance without major traffic disruption.
- 5.7.16 For those reasons outlined above this alternative was not considered to be feasible.

Dynamic Lane Management

Description

- 5.7.17 A number of schemes have been introduced on busy sections of dual carriageway which exhibit a strong peak direction bias in order to utilise under used contra-peak direction capacity. Traffic management systems can be introduced to allow specified lengths of individual lanes to

become reversible. This enables additional lanes to be made available to peak traffic by allocating contra-flow lanes to the peak flow direction, which are also closed to contra-peak flow.

- 5.7.18 The success of this alternative is dependant upon the operation and capacity of the adjoining local highway network. Such a scheme requires an identified peak direction, and sufficient spare capacity in the contra-peak direction and the scheme must ensure that the lane management scheme does not just set up an inconsistency in the local network which itself causes congestion. There also needs to be sufficient space laterally to accommodate the traffic and such separations as required for safety reasons.

Discussion

- 5.7.19 Dynamic lane management could in theory be implemented on the SJB to reduce congestion. However, there is little evidence of tidal flows (i.e. the SJB peaks are simultaneous in both directions rather than tidal) in the peaks on the SJB and lengthy queues develop on all approaches in both morning and afternoon peaks. Lane management systems would therefore not have any impact on peak congestion and this alternative was therefore discounted. This would also require legislation.

Selective Access by Vehicle Tagging

Description

- 5.7.20 Based on vehicle number plate recognition technology or vehicle tagging systems, access to infrastructure can be regulated to specified time periods for groups of vehicles, with a back-up system of deterrent fines and enforcement, thereby reducing demand for highway access at any given time. This could in theory be implemented on the approaches to the SJB.

Discussion

- 5.7.21 There are limitations to the effectiveness of this type of concept in terms of how to deal with non-local vehicles, growth in multi-vehicle ownership, and wider practicalities. As only 20%¹ of the current traffic on the SJB makes local trips within the Borough and alternative routes are over 10 miles away, i.e. the M6/Mersey Tunnels, this alternative is not a feasible option within Halton and was therefore discounted (Gifford, 2004).

Infrastructure Instruments – Utilising the Existing SJB

Road Space Re-allocation

Description

- 5.7.22 A key aim of such a solution is to improve public transport provision. A major constraint upon public transport is the current level of congestion on the approaches to the SJB. This alternative aims to dedicate lanes on a highway for specific modes of transport such as buses, taxis, high occupancy vehicles and, conceivably, other forms of public transport such as light rail. The performance of this alternative is dependent upon the frequency of use of the allocated lane and level of enforcement against unauthorised use.

¹ All traffic diversion figures have been obtained from traffic surveys undertaken as part of the Major Scheme Appraisal (Gifford, 2004).

Discussion

- 5.7.23 This alternative could in theory be implemented on the SJB and would link into the bus network in Runcorn and any bus priority measures on the north bank in order to maximise effects. Bus / taxi lanes have been provided on both the Widnes and Runcorn approaches to the SJB. However, there is no capacity on the bridge deck to allocate road space other than for all-purpose traffic and this means that all the traffic which has been separated on the approaches must re-combined to cross the SJB, achieving nothing in terms of congestion relief or easing flows. Therefore road space re-allocation was not considered to be a feasible alternative.

Park and Ride

Description

- 5.7.24 Park & Ride has the potential to divert some travellers from the use of the private car to public transport and was considered as an alternative to relieve congestion on the SJB. Research has shown that for a Park & Ride to be successful several key factors are vitally important. These include car parking policy at the destination, the location of the Park & Ride car park site and the frequency of the service. The Park & Ride must also be as close as possible to the destination to enable a high frequency and reliable service between the Park & Ride and destinations, keep fares low and minimise the in-car journey time.
- 5.7.25 In terms of Halton, a park and ride solution would need to focus on demand for trips to central points. In the case of the SJB this could be Liverpool City Centre.

Discussion

- 5.7.26 Surveys undertaken indicate that destinations of trips made across the SJB are too dispersed to make this option a viable alternative and it was therefore discounted. The proportion of local trips using the SJB are low at 20%, the journey times are long and with a Park & Ride site in Runcorn, the bus service would encounter the existing congestion on the SJB and approaches. Therefore, this alternative was discounted.

Infrastructure Developments – New Fixed Links

Rail Service Improvement

Description

- 5.7.27 This alternative involves the improvement of rail services between key origin and destinations. This would include improvements to rail station access and service characteristics to enable rail to become a more viable option for cross river trips.

Discussion

- 5.7.28 The largest single movement across the River is between Runcorn and Widnes. Unfortunately, the rail network is unable to have any impact on trips between Runcorn and Widnes as there is no station in Widnes on the main line that crosses the Mersey. Even if such a solution were provided it would not be in central Widnes. Another key destination for traffic crossing the Estuary includes Liverpool City Centre. Again, the dispersion of destinations across the city centre and the distribution of origin points would have the effect of significantly reducing the potential for rail to be a viable mode for most of these trips. For rail to be effective the access and egress points to the rail network need to correlate closely with the origin/destination/modes of the trips being undertaken. Local access to the rail network is limited and the level of service

to Liverpool is relatively low, but this is a secondary consideration compared to the wide dispersion of trip origin/destination points.

- 5.7.29 A potential solution could be improvements to railway station access and service characteristics to enable rail to become more viable for a greater number of cross-river trips currently undertaken by road.
- 5.7.30 The Council is working closely with Merseytravel to promote the reinstatement of local rail services on the Halton Curve to enable services to run between south Liverpool to Chester and north Wales via Runcorn. This would provide a rail alternative for a proportion of the current cross river traffic using the SJB. However, due to the dispersed trip origins and destinations this is not a feasible option on its own for addressing the concerns relating to the SJB and was therefore discounted.

Bridge to the West of the Railway Bridge

Description

- 5.7.31 A bridge to the west of the SJB was considered as a potential fixed crossing alternative.

Discussion

- 5.7.32 A bridge to the west of the Railway Bridge would pass through the nationally and internationally designated ecological site within the Estuary, including the Natura 2000 and SSSI designations. This would be likely to give rise to significant environmental effects, which could be expected to affect the integrity of these protected sites. In addition, bridge crossing options in this location 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 for a bridge crossing were therefore dismissed as possible alternatives.

Fixed Crossing between the SJB and the Railway Bridge

Description

- 5.7.33 A crossing between the SJB and Railway Bridge was considered as an alternative to relieve congestion.

Discussion

- 5.7.34 This alternative was discounted for the following reasons:
- a. There is insufficient width for a new crossing in this location (Plate 5.1): The available width, at a pinch point between the existing bridges (SJB and Railway Bridge) is 21.048m, allowing for 3m of clearance on each side between bridges. However, the width required for a new crossing would need to be 24.25m to accommodate 2 no. 7.3m carriageways with 3.7m wide hardshoulder and 2.25m central reservation;
 - b. There is insufficient room for an in-line bridge pier. If this space were not provided any new crossing, like the SJB, would be sub-standard in highways terms. A new bridge pier, in-line with the existing piers, would 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; and

Plate 5.1 - View between the SJB and Railway Bridge

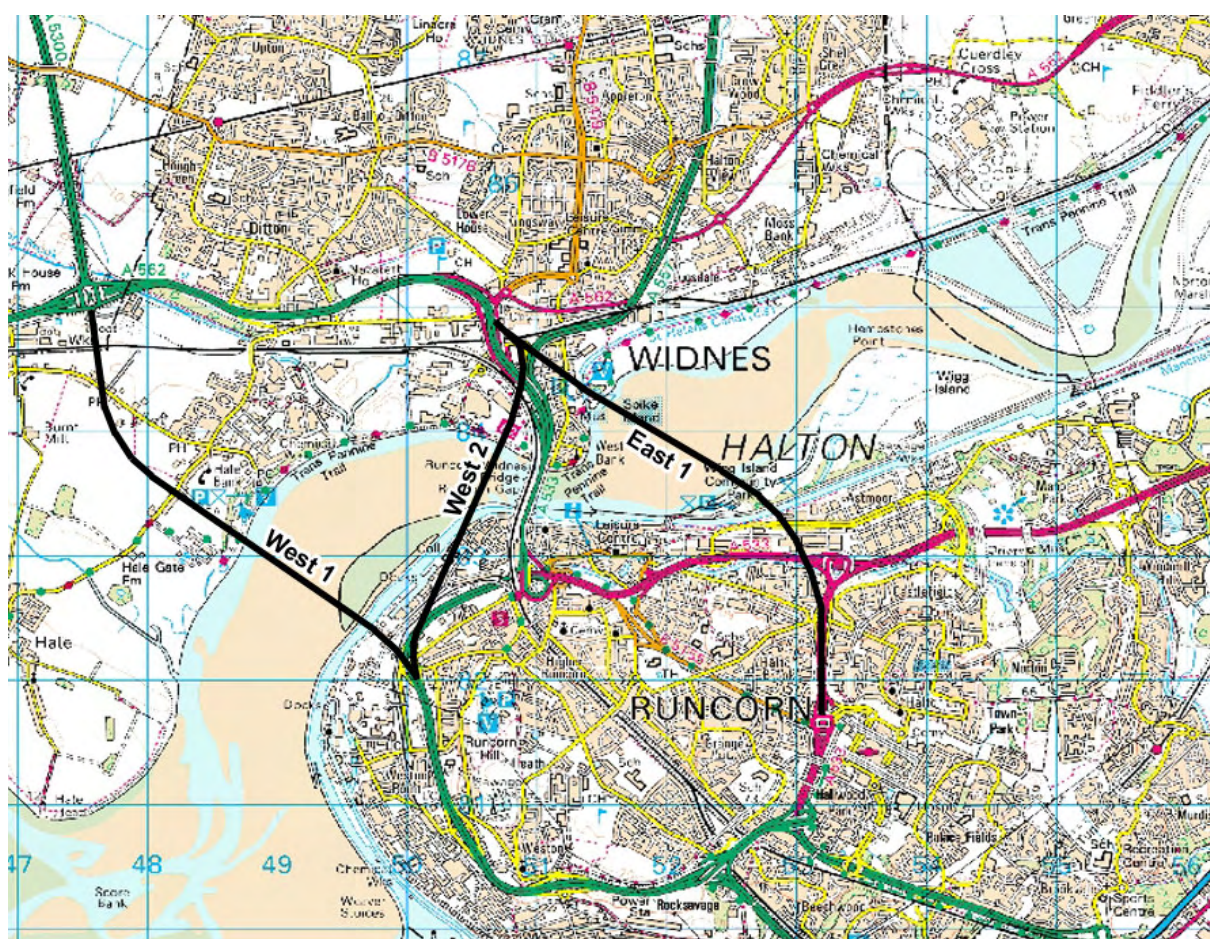


- c. The existing SJB approach viaducts in Runcorn and Widnes would need to be demolished and new approach viaducts constructed to accommodate the approaches to the new crossing and the realigned approaches to the SJB. This would cause unmanageable traffic disruption.

Tunnels

- 5.7.35 Three alternatives for a tunnel to the west and east of the SJB were considered as shown in Figure 5.13 below.

Figure 5.13 – Tunnel Options



Description

- 5.7.36 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 Estuary (which is designated as a SPA, Ramsar, European Marine Site and SSSI) before rising beneath Pickering's Pasture LNR 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.
- 5.7.37 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, West Coast Main Line (Liverpool Branch) Railway and A533 and link into the existing Speke Road Roundabout.
- 5.7.38 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 north west beneath the residential area of Halton Brook, Astmoor Industrial Estate, the Manchester Ship Canal, the River, Spike Island and industrial areas immediately to the north of West Bank before joining the existing road network at the Speke Road Roundabout.
- 5.7.39 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 for police / rescue vehicles.

- 5.7.40 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 was 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.

Discussion

- 5.7.41 Option West 1 would affect 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 effect on the farms and countryside but increased costs would be significant.
- 5.7.42 Option West 2 would have minimal effect on residential areas but would have some effect on existing industrial areas. The main concerns associated with the construction of this route would be the effect on the railway and the disturbance of contaminated land in the area to the east of the A533 and railway in Widnes, which is known to be heavily contaminated.
- 5.7.43 Option East 1 would have an effect on residential and industrial areas. The main concern associated with the construction of this route would be the disturbance of contaminated land in the areas to the east of the A533 and railway in Widnes, which is known to be heavily contaminated.
- 5.7.44 In view of the major concerns regarding the construction of a tunnel on routes West 2 and East 1, and the fact that cheaper bridge options to the east of the SJB are considered to be viable, only the tunnel to the west of the SJB was considered further in the MSA process.
- 5.7.45 Option West 1 was compared against the MSA objectives (see paragraph 5.11.2). This option would attract little traffic from the SJB and this would not be of a sufficient level to allow the SJB to be reduced to two lanes. This would reduce the ability for improvements to public transport and pedestrian and cycle routes. It was also considered to offer limited improvements to economic development areas in terms of access. It was therefore considered that this alternative did not achieve the objectives set out for the MSA process and was therefore also discounted.

New Bridge Adjacent to or East of the SJB

Description

- 5.7.46 A new fixed crossing could be provided adjacent to or to the east of the existing SJB and Railway Bridge.

Discussion

- 5.7.47 Traffic modelling indicates that a fixed crossing to the east of the SJB has the potential to attract traffic away from the SJB, thus relieving congestion. This traffic relief over the SJB has the potential to allow development sites to its east to be released for development. Depending on the degree of traffic relief from the SJB, it has the potential to provide improved public transport, cycle and pedestrian links across the River. This alternative is feasible and was therefore taken forward for further consideration as part of the project development.

Conclusions

- 5.7.48 Table 5.3 provides a summary of those strategic transport planning alternatives that were considered. In summary it can be seen that a bridge to the east of the SJB was the only alternative which was considered to be feasible and able to overcome the accessibility, regeneration and socio-economic issues identified in Halton (Table 5.1).

Table 5.3 – Summary of Strategic Transport Planning Alternatives

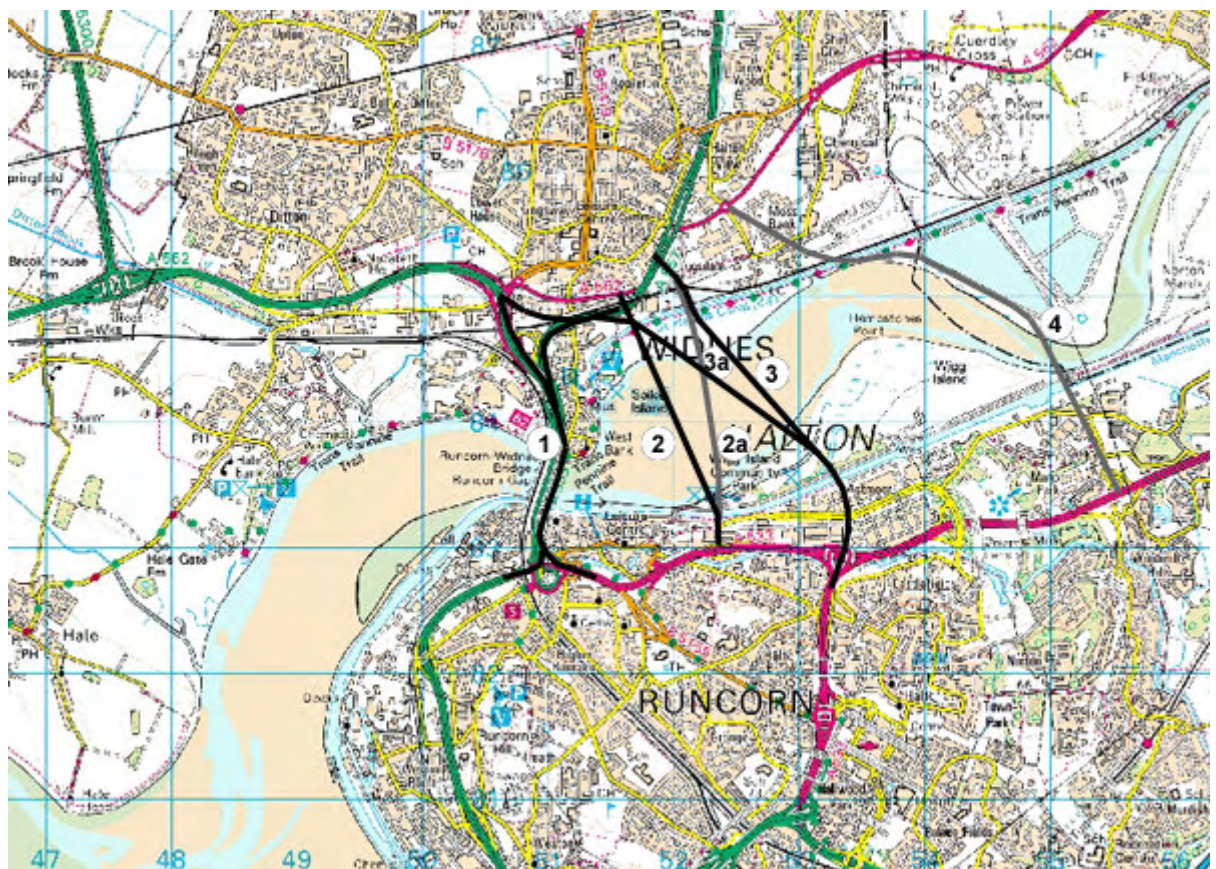
Alternatives	Alternative considered feasible	Explanation
Halton Travel Plan	x	Unlikely substantially to reduce travel demand and hence relieve congestion on the SJB. Difficult to implement a borough wide travel plan, especially where journeys begin or end outside the borough.
Charging for using the Existing Bridge or Other Roads	x	The physical process of collecting the payment would impose additional delays on travellers across the SJB. The existing SJB and its approaches would not be able to accommodate tolling facilities on the necessary scale. In addition public, cycle and pedestrian improvements would not be possible.
Dynamic Lane Management	x	Little evidence of tidal flows on the SJB means that lane management would not reduce peak congestion.
Selective Access by Vehicle Tagging	x	Non-local vehicles, growth in multi-vehicle ownership and wider practicalities would be difficult to deal with as only 20% of the current traffic on the SJB makes local trips within the Borough.
Road Space Reallocation	x	There is no capacity on the SJB deck to allocate road space other than for all purpose traffic therefore congestion would not be relieved.
Park and Ride	x	Trips made across the SJB are too dispersed.
Rail Service Improvement	x	Due to the dispersed trip origins and destinations.
Bridge crossing to the West of the Railway Bridge	x	A bridge to the west would have unacceptable effects on designated sites within the Estuary.
Bridge crossing between the SJB and the railway bridge	x	Insufficient width for a crossing in this location.
Tunnels to the west and east of the SJB	x	Option West 1 would affect a number of residential properties and farms and would require structures over two existing roads and one railway line. In addition it would not achieve the objectives for the MSA.

Alternatives	Alternative considered feasible	Explanation
		Option West 2 would affect some residential and industrial areas. It would also affect the railway and disturb heavily contaminated land. Option East 1 would affect both residential and industrial areas and disturb heavily contaminated land in the area.
Bridge crossing (adjacent to and to the east of the SJB)	✓	Offers sufficient traffic relief to the SJB, allowing improvements in public transport, cycling and pedestrian facilities across the River.

5.8 Fixed Route Alternatives – to the East of the SJB

- 5.8.1 As noted in Chapter 2 a number of alternative options for the location of a fixed crossing to the east of the SJB were considered in detail through the MSA process. The following section summarises fixed route alternatives that have been considered in the Project's development.
- 5.8.2 The location and alignment of the fixed route alternatives considered are shown in Figure 5.14.

Figure 5.14 - Alternative Fixed Routes



Route 1 - Immediately Upstream East of the SJB

Description

5.8.3 Route 1 (also known as the on-line option) extends from the junction of the SJB with the Weston Point Expressway on the south bank, crosses the Runcorn Gap along the east side of the SJB and rejoins the existing highway at West Bank on the north bank (as shown on Figure 5.14). It is the shortest possible crossing in the study area. The proposed structure would be on the eastern side of the SJB.

5.8.4 There are two options for the design of Route 1's main structure which include:

- a. Cable Stayed Span – 2 large tower structures with one on the northern margin of the intertidal channel. 6 on-land piers within the residential areas of West Bank and Runcorn Old Town; and
- b. Multi-Span – 2 pier structures in the intertidal channel. 8 on-land piers within the residential areas of West Bank and Runcorn Old Town.

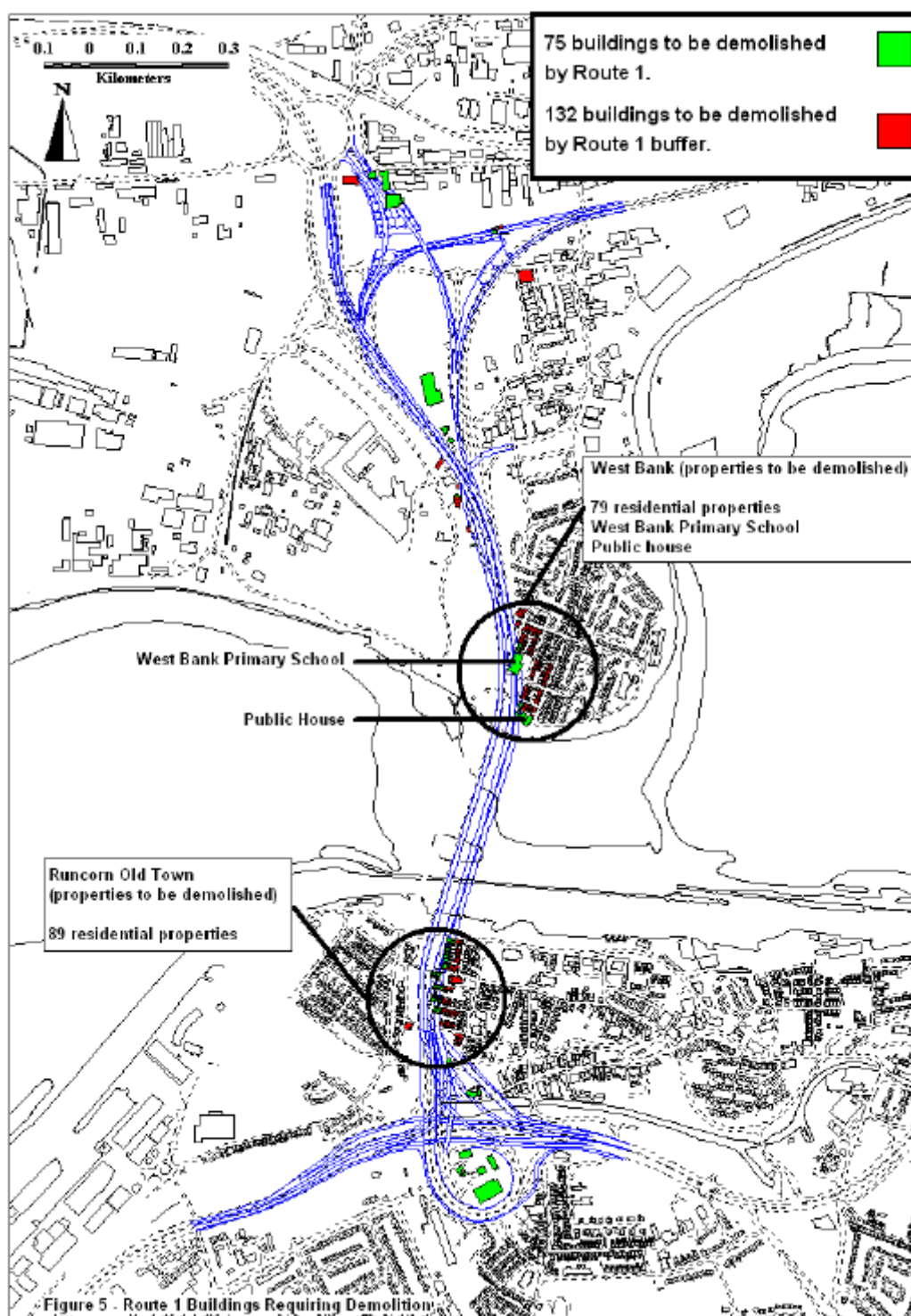
Discussion

5.8.5 Route 1 would have a significant adverse effect on the communities of Runcorn Old Town and Widnes West Bank, requiring the demolition of residential properties, local businesses and other amenities. Figure 5.15 and Table 5.4 show the extent of demolition that would be required for the construction of Route 1.

Table 5.4 - Buildings for Demolition for On-Line Option

Area	Demolition
Runcorn Old Town	140 residential properties
	1 educational building
	1 surgery
	1 chapel
	1 public house
Widnes West Bank	85 residential properties
	1 primary school
	1 public house
	3 industrial units

Figure 5.15 - Demolition of Properties required for Route 1



5.8.6 A significant amount of money has already been spent on regenerating Runcorn and Widnes and a number of future regeneration strategies are planned. Figures 5.16 and 5.17 illustrate completed, under construction and planned regeneration and development, highways and enhancement initiatives within Widnes and Runcorn.

Figure 5.16 - Regeneration and Development, Highway and Enhancement Initiatives in Widnes (Ref. 1)

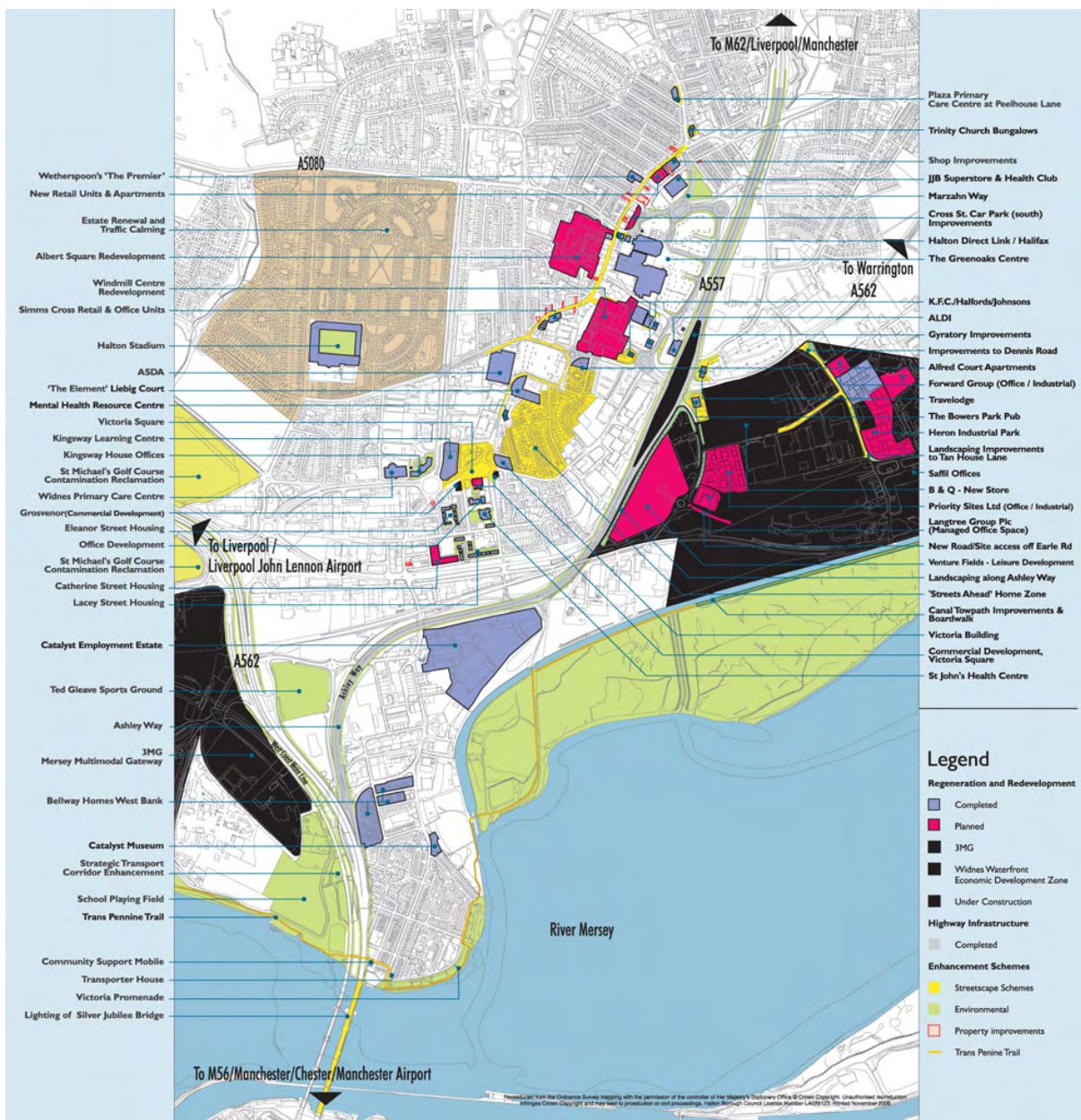
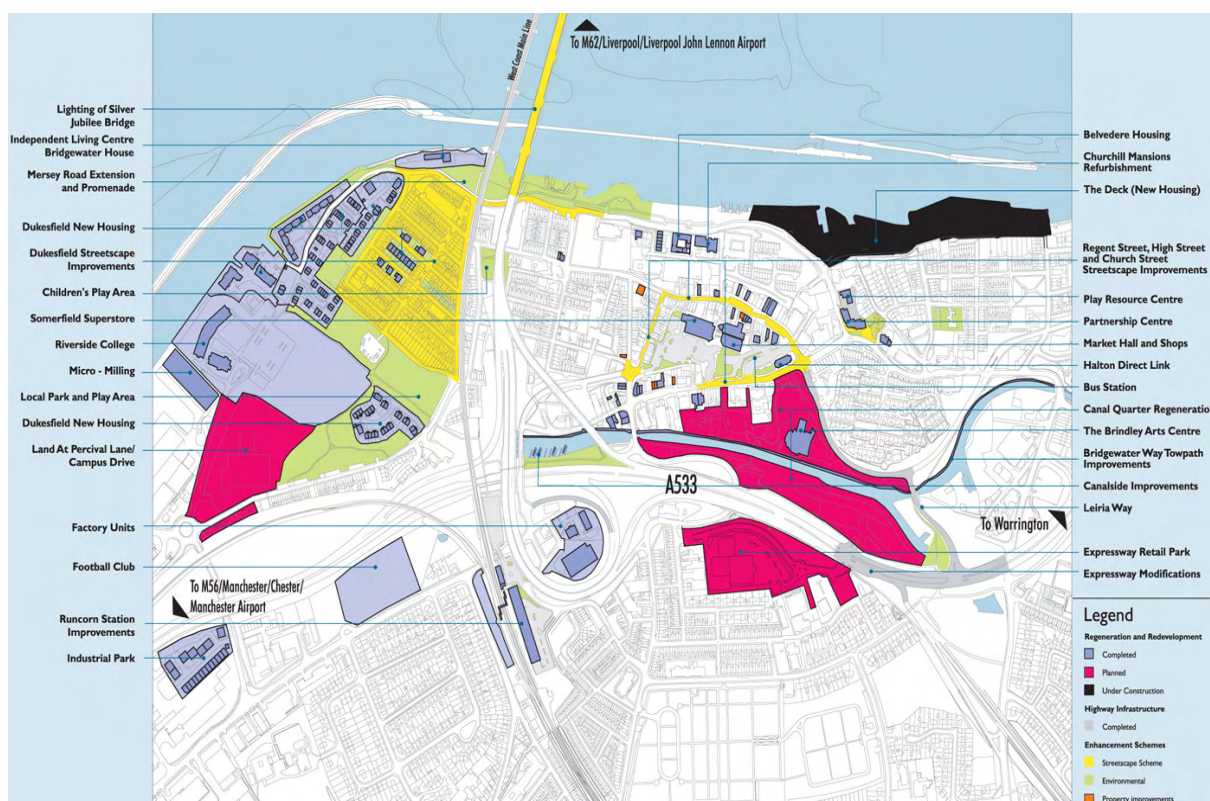


Figure 5.17 - Regeneration and Development, Highway and Enhancement Initiatives in Runcorn (Ref. 1)



5.8.7 Route 1 would have a significant adverse effect on some of these regeneration areas.

Single Regeneration Budget (SRB) Investment

5.8.8 Route 1 would have a significant detrimental effect on the Runcorn Old Town area SRB which has already received investment.

5.8.9 In overall terms, £12.7 million of SRB was directed in to the Old Town Area between 1996 and 2003, which levered in further resources of £33 million.

5.8.10 Land where Route 1 connects to Runcorn, close to the Dukesfield area, is part of the SRB programme and has been designated as a Housing Renewal Area. Financially, £3.7 million of SRB was used to improve the Dukesfield area which was matched by £4.8 million of Private Sector funds and £0.5 million of Public Sector funds. This led to 25 private sector dwellings being improved, 62 new private sector dwellings built, 59 new Housing Association dwellings built and a further 73 improved - the viability of this area would be blighted by the long term increase in traffic and also by the severe disruption during construction.

Halton Waterside Development Strategy

5.8.11 Route 1 would have an adverse effect on the Council's proposed strategy for the Halton Waterside Development. It would have an adverse effect on the visual setting of Halton's waterfront and in particular on the setting of the existing listed bridges. Route 1 would take up land within prime waterfront development areas in both Runcorn Old Town and Widnes West

Bank. This could jeopardise regeneration proposed for the waterfront area in the long term. In the short term the disruption due to construction would blight the waterfront area.

West Bank Development Framework

- 5.8.12 Route 1 would not allow the maximisation of the waterfront potential in West Bank and would result in the deterioration in environmental quality in this area. Businesses in this area would be severely affected during construction and jobs would be lost in the long term due to the demolition of community facilities.

Runcorn Historic Canal Town Masterplan/Development Brief

- 5.8.13 Runcorn Old Town is situated on three waterways; the Bridgewater Canal, the Manchester Ship Canal and the River Mersey. A Masterplan has been developed by the Council for the Old Town area with the aim of regenerating it as a historic canal town. The aims of the Masterplan are to:
- a. Re-integrate Runcorn Historic Canal Town centre with the waterfronts of Bridgewater Canal and Manchester Ship Canal/ River Mersey;
 - b. Improve the environmental quality of Runcorn Historic Canal Town through improvements to the waterfront areas;
 - c. Bring additional economic activity into Runcorn Historic Canal Town by creating a more attractive and vibrant area;
 - d. Develop derelict and underused sites into active and high quality uses;
 - e. Develop the 'Runcorn Historic Canal Town' image and brand that are unique in the area;
 - f. Give each waterfront a different but active function and identity to avoid competition both between the waterfronts and between the waterfronts and the core of the town centre;
 - g. Bridgewater Canal: leisure, retail and commercial focus with secondary residential; and
 - h. Manchester Ship Canal: residential focus with some ancillary retail and commercial.

- 5.8.14 Route 1 would have an adverse effect on the Runcorn Canal Basin with five separate structures crossing this area. This in turn would clearly have a significant effect on plans to develop the Runcorn Historic Canal Town. As with West Bank, Route 1 would result in deterioration in environmental quality in this area. Businesses in the area would be severely affected during construction and jobs would be lost in the long term due to the demolition of community facilities.

Environmental Effects

- 5.8.15 Hydrodynamic modelling has indicated that the placement of an additional crossing within footings in the Estuary adjacent to the existing SJB and Railway Bridge crossing structures would result in adverse effects on the hydrodynamic processes within the Estuary at this point. This point is a natural control point in the Estuary and it is anticipated that any changes at this location would result in downstream negative effects. This would lead to subsequent unacceptable negative effects on the Natura 2000 and SSSI sites which are located downstream of the SJB.
- 5.8.16 The visual assessment undertaken as part of the MSA indicates that Route 1 (in particular the cable stayed span option) has the greatest negative visual effects when compared to other fixed bridge route options. The visual effects of this on-line option on landscape and townscape, and its effect on the existing Grade II and II* listed bridges were considered to be negative. Route 1 would be contrary to policy BE11 in Halton's UDP which states that *'Developments which would affect the setting of a listed building should aim to preserve both the character of that setting and its historic relationship to the listed building ...'*. Furthermore Route 1 is the only fixed bridge crossing assessed in the MSA cultural heritage assessment with the potential negatively

to affect the Saxon *burh*, Roman crossing point, the Conservation Areas of the Runcorn Old Town and Widnes West Bank, and the old transporter bridge, due to its location.

- 5.8.17 Due to the location of Route 1 in close proximity to residential properties, it would have the greatest negative effect on resident health (when compared to other fixed bridge alternatives) due to changes in local air quality and background noise levels as a result of increased traffic in this area.
- 5.8.18 A navigation assessment indicates that Route 1 would permanently reduce clearances on the Bridgewater Canal and result in some permanent changes to Runcorn Basin. This would result in negative effects on the navigation of the Bridgewater Canal
- 5.8.19 The entire length of Route 1 was located in a Public Information Zone (PIZ) associated with the (former) Tessengerlo Site. This implies that in certain circumstances people within the zone may be at significant risk from major accidents. Since this study, the PIZ has been removed. Therefore, this is no-longer a relevant consideration.

Summary

- 5.8.20 Route 1 was discounted as an alternative for the following reasons:
 - a. Demolition of a number of properties (residential, social facilities and commercial);
 - b. Adverse effects on regeneration areas within Runcorn and Widnes;
 - c. Its location within a PIZ;
 - d. Unacceptable effects on the hydrodynamic regime and knock-on downstream effects on designated ecological sites;
 - e. Decreased local air quality and increased noise levels; and
 - f. Visual and cultural heritage effects on the existing Grade II and II* Listed Bridges and Conservation Areas.

Route 2

Description

- 5.8.21 Route 2 is located approximately one kilometre upstream from the SJB (as shown on Figure 5.14 above). 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 saltmarshes before crossing the Estuary. On the north bank, it crosses the saltmarshes, St. Helens Canal and railway line before joining Ashley Way to the west of Rhodia.

Discussion

- 5.8.22 Route 2 does not impact directly on any regeneration areas within Runcorn or Widnes.
- 5.8.23 Traffic modelling undertaken as part of the MSA (Gifford, 2004) shows that approximately 38% of traffic would remain on the SJB and 62% of crossing traffic would go towards Route 2. The MSA stated that at this level there would be potential to reduce SJB to two lanes, but this would be marginal, with SJB remaining very busy and less attractive to public transportation. The high residual levels of traffic on the SJB would also detract from the effectiveness of measures for cyclists and pedestrians.
- 5.8.24 Route 2 does not connect directly to any of the main routes feeding the crossing, instead requiring traffic to travel along the banks on both sides to reach the crossing. The freight railway in Widnes and topographical constraints in Runcorn mean that fully free flowing junction options

cannot be accommodated at the ends of Route 2. This adversely affects the predominant movements between Speke Road and Weston Point, such that a relatively high proportion of traffic would prefer to use SJB given the option. Increased traffic along Bridgewater Expressway through Old Runcorn to link with Weston Point Expressway, which is already subject to reduced speed limit and traffic signal control, will be impacted by Option 2

- 5.8.25 If additional measures were to be undertaken to divert more traffic onto the new crossing e.g. by de-linking approach roads to the SJB this would impose longer journeys on key crossing trips with a consequent reduction in economic benefit of the option and implications for local air quality.
- 5.8.26 The cultural heritage assessment undertaken as part of the MSA indicated that Route 2 has the potential to negatively affect the setting of the Listed Bridges to its west.
- 5.8.27 Although Route 2 showed some of the same benefits of the route eventually selected, this alternative did not show as many benefits as Route 3A (see Paragraph 5.8.44).

Route 2A

Description

- 5.8.28 Route 2A is approximately 1.25 km upstream from the SJB (as shown on Figure 5.10). 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 saltmarshes before crossing the Estuary. On the north bank, it crosses the saltmarshes, 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 respectively.

Discussion

- 5.8.29 The Widnes Waterfront EDZ (as discussed in Chapter 4) has secured £8 million of European Regional Development funds and will also benefit from a new crossing but would be adversely affected by Route 2A. Route 2A would have a negative effect at the western end of the site and would result in the loss of some land and consequently reduce the benefits of the EDZ.
- 5.8.30 Traffic modelling undertaken as part of the MSA process indicates that Route 2A attracts significantly less traffic than Route 2 due to the configuration of the junctions and the alignment of the route which adds significantly to the journey length of a high proportion of crossing trips. Whilst providing enough relief to SJB to allow delays to be reduced, two lanes in each direction would need to be retained on SJB, jeopardising cycling and walking objectives for SJB
- 5.8.31 Route 2A completed the set of crossing routes linking potential junction areas either side of the Mersey (see also Routes 2, 3 and 3A), but in most respects is inferior to other options and in particular to Route 2. Whilst it offers greater flexibility to realise potential operational benefits for the Widnes junction, the additional journey length for the majority of crossing trips is significant, leading to high proportions of trips remaining on SJB or adversely affecting the economics of the scheme if measures were taken to limit capacity on SJB.
- 5.8.32 Route 2A was discounted as an alternative due to the following reasons:
 - a. Route 2A is a longer route for the majority of crossing trips when compared with Routes 2, 3 and 3A and therefore will not provide as significant reductions in journey time;

- b. Traffic modelling suggests that traffic on the SJB would not be reduced sufficiently to allow a downgrade in lane numbers and consequent improvements for cycling and pedestrians across SJB;
- c. 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; and
- d. 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

Route 3

Description

- 5.8.33 Route 3 is located approximately 1.8 km upstream of the SJB (as shown on Figure 5.14 above). It starts on the south side of the River at the junction of the Bridgewater, Daresbury and Central Expressways, crosses Astmoor Industrial Estate, the Manchester Ship Canal and the edges of the saltmarshes before crossing the Estuary. On the north bank, it crosses the saltmarshes, St. Helens Canal and railway line before joining Ashley Way to the east of Rhodia.

Discussion

- 5.8.34 Traffic modelling undertaken as part of the MSA shows that the existing SJB would attract 26% of traffic, and there would be a diversion of about 74% of traffic with a peak flow of 3789 vehicles per hour onto Route 3 by the design year (2022). Route 3 demonstrates a good potential to transfer strategic traffic onto a new crossing.
- 5.8.35 Route 3 provides a direct link to Central Expressway, and therefore an efficient link back to M56 on the Runcorn side, but adds additional journey length for a significant number of trips along the Widnes bank towards Speke Road, in combination with existing non crossing trips. Compared to Route 3A the additional journey length for many crossing trips is significant, leading to higher proportions of trips remaining on SJB or adversely affecting the economics of the scheme if measures were taken to limit capacity on SJB.
- 5.8.36 Public transport would be able to use both Route 3 and the SJB with priority lanes up to some junctions. Congestion relief would further benefit public transport reliability. Route 3 would also allow cycling and pedestrian facilities on the SJB to be improved.
- 5.8.37 The Widnes Waterfront EDZ (Chapter 4) would be adversely affected by Route 3. Route 3 would have an adverse effect at the western end of the site and would result in the loss of some land and consequently reduce the benefits of the EDZ. Congestion relief would improve access to existing areas of development but this would be limited due to lack of ability to provide grade separated junctions at the southern end of the Route 3.
- 5.8.38 Route 3 was ultimately discounted as an alternative as it has a negative effect on the Widnes Warth EDZ and did not show as many benefits as Route 3A (see Paragraph 5.8.44).

Route 3A

Description

- 5.8.39 Route 3A is located approximately 1.6 km upstream of the SJB (as shown on Figure 5.14). 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 saltmarshes before crossing the estuary. On the north bank, it crosses the saltmarshes, St. Helens Canal and railway line before joining Ashley Way to the west of Rhodia.

Discussion

- 5.8.40 Route 3A does not directly affect any regeneration areas. Congestion relief (discussed below) would improve access to existing areas of development and access to Astmoor and south east Widnes would be improved.
- 5.8.41 Traffic modelling undertaken as part of the MSA for this option showed that the existing SJB would retain approximately 21% of traffic, in the design year (2022). Route 3A would result in significant traffic alleviation on Bridgewater Expressway, with peak flows in the design year of less than 1000 vehicles per hour, the equivalent traffic level across the Central Expressway onto the M56 would be substantially increased resulting in peak flows of 4065 vehicles per hour.
- 5.8.42 When compared to Routes 2, 2A and 3, Route 3A achieved the highest proportion of trips using the new crossing in preference to SJB without resorting to measures to limit capacity on SJB. This is possible because the Central Expressway and Weston Point Link offer a viable and competitive alternate route for traffic from M56 Junction 12 to the crossing. Further Route 3A links directly into Speke Road on the Widnes side, such that traffic has a free-flowing grade separated route from M56 through to Speke Road, which matches the existing provision across SJB, but without the capacity and geometric constraints associated with the existing bridge. Compared to other options this minimises the volume of traffic using the junction arrangements to join or leave the primary Mersey gateway corridor, and where most of potential delays would occur. Route 3A allows crossing traffic to be dispersed efficiently onto routes to/from the crossing, minimising the conflict with local non-crossing traffic.
- 5.8.43 Public transport would be able to use both Route 3A and the SJB with priority lanes up to some junctions. Congestion relief would further benefit public transport reliability. Route 3A would also allow cycling and pedestrian facilities on the SJB to be improved.
- 5.8.44 The reasons that Route 3A is considered to be a feasible alternative are summarised below:
- Route 3A, which comprises the optimum elements of the Route 2 and Route 3 alignments, lies naturally on the desire line for through traffic. As a result, it achieves the highest proportion of trip reassignment from the SJB when compared with other routes and therefore provide the strategic and local traffic diversion required. This satisfactorily relieves the SJB and permits its return to local use. The only other alternative to achieve a similar traffic diversion was the on line alternative, Route 1. However this option was discounted based on the reasons provided in paragraph 5.12.22;
 - Route 3A has relatively simple junction solutions in comparison to other variations of this route options (Route 2, 3 and 2A);
 - Route 3A avoids residential areas and has a minimal impact on industrial areas (unlike Route 1). Its elevation on the southern bank provides a real opportunity for exploiting the area under the bridge within the Astmoor estate for commercial use; and
 - Route 3A involves the least impact on the existing highway network requiring a minimum of disruption to traffic and the local economy during construction.

Route 4

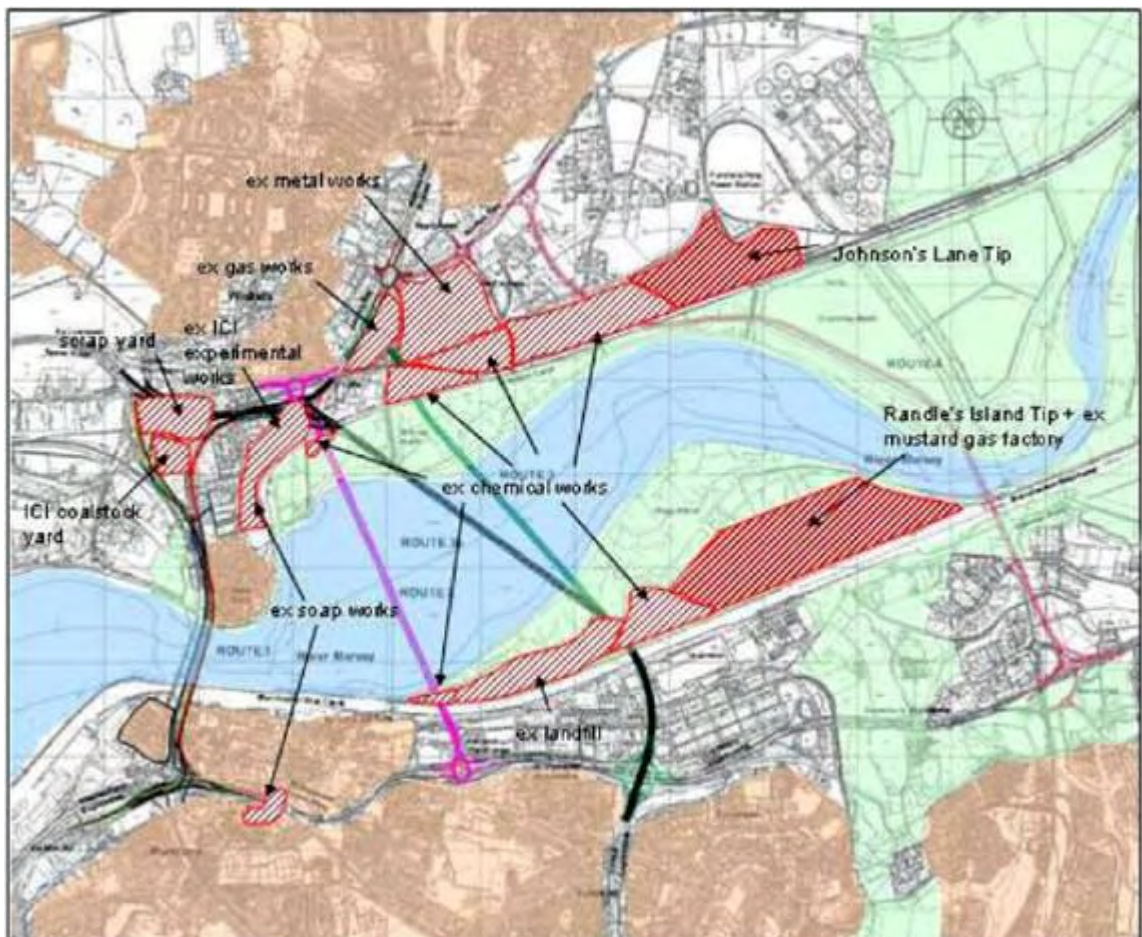
Description

- 5.8.45 Route 4 was proposed by The Acting Mersey Conservator and supported by the Environment Agency as an option that they considered would minimise effects on the hydrodynamics of the River. Route 4 is located approximately 4.5 km upstream of the SJB (as shown on Figure 5.14 above). 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 saltmarshes, St. Helens canal and the railway line on a separate structure and joining Fiddlers Ferry Road west of the power station.

Discussion

- 5.8.46 Contamination is a significant negative constraint for the alignment of Route 4. Figure 5.18 highlights the areas of potentially significant contamination. The two areas shaded darker red, Johnson's Lane Tip in Widnes and Randles Island Tip in Runcorn, are to be avoided due to high levels of contamination and associated risks and were therefore instrumental in defining the alignment of Route 4.

Figure 5.18 - Areas of Contamination



- 5.8.47 The Widnes Waterfront EDZ would be affected by Route 4. Route 4 would have an effect at the eastern end of the EDZ where the alignment was changed to avoid the contaminated Johnson's Lane Tip. Route 4 would have to be taken around the northern perimeter of the EDZ to minimise the impact on this Development. If Route 4 were taken directly through the EDZ this

would clearly have a significant negative effect on the development proposals with the alternatives either being to split the site in two by the new road or to run along the canal corridor which would have significant impact on the visual aspects of the EDZ.

- 5.8.48 The traffic modelling undertaken as part of the MSA shows that Route 4 would only attract 47% of traffic in the design year from the SJB, but this figure was found to be much lower at opening (2007). The increase in flow at design year could not, therefore, be attributed to journey-time savings, but as a consequence of increasing congestion on the SJB. It can be seen that the attraction of traffic to the proposed Route 4 would not be of a sufficient level to allow the SJB to be reduced to two lanes.
- 5.8.49 Minimal congestion relief on SJB would not significantly improve access to existing areas of development but access to east south east Widnes and Manor Park would be improved.

Conclusion

- 5.8.50 Table 5.5 below provides a summary of those fixed route alternatives that were considered during the MSA process.

Table 5.5 – Summary of Fixed Route Alternatives

Alternatives	Alternatives taken forward?	Explanation
Route 1	✗	Due to the number of properties required for demolition, effects on regeneration areas, its location within a PIZ, the unacceptable effects on designated ecological sites, noise and air quality issues and visual and cultural heritage effects Route 1 was not considered to be a feasible alternative.
Route 2	✗	Traffic modelling indicated that, although Route 2 would allow the SJB be reduced to two lanes, traffic relief would be marginal and the SJB would remain busy and with limited potential to provide improvements for public transport, cyclists and pedestrians. Options for de-linking of the SJB approach roads would impose longer journeys on crossings. For these reasons Route 2 was not considered to be a feasible alternative.
Route 2A	✗	Due to its length Route 2A would not provide a significant reduction to traffic using the SJB and therefore not allow a downgrade in the number of lanes. In addition access via the junctions to the north and south of the River was considered to be indirect and not ideal. For these reasons it was not considered to be a feasible alternative.
Route 3	✗	Due to its negative effects on the Widnes Waterfront EDZ and the fact that it did not show as many benefits as Route 3A, Route 3 was not ultimately considered to be an acceptable alternative.
Route 3A	✓	Route 3A offers the following benefits and was therefore considered to be a feasible alternative: a. Route 3A, which comprises the optimum elements of the Route 2 and Route 3 alignments, lies naturally on the desire line for through traffic. As a result, it achieved the highest proportion of trip reassignment from the SJB when compared with other routes and

Alternatives	Alternatives taken forward?	Explanation
		<p>therefore provide the strategic and local traffic diversion required. This satisfactorily relieves the SJB and permits its return to local use. The only other alternative to achieve a similar traffic diversion was the on line alternative, Route 1. However this option was discounted based on a number of reasons provided;</p> <p>b. Route 3A has relatively straight forward junction solutions in comparison to other variations of this route options (Route 2, 3 and 2A);</p> <p>c. Route 3A avoids residential areas and has a minimal impact on industrial areas (unlike Route 1). Its elevation on the southern bank provides a real opportunity for exploiting the area under the bridge within the Astmoor estate for commercial use; and</p> <p>d. Route 3A involves the least impact on the existing highway network requiring a minimum of disruption to traffic and the local economy during construction.</p>
Route 4	*	Due to its location within an area of heavy contamination, potential effects on Widnes EDZ and minimal congestion relief on the SJB it was not ultimately considered to be an acceptable option.

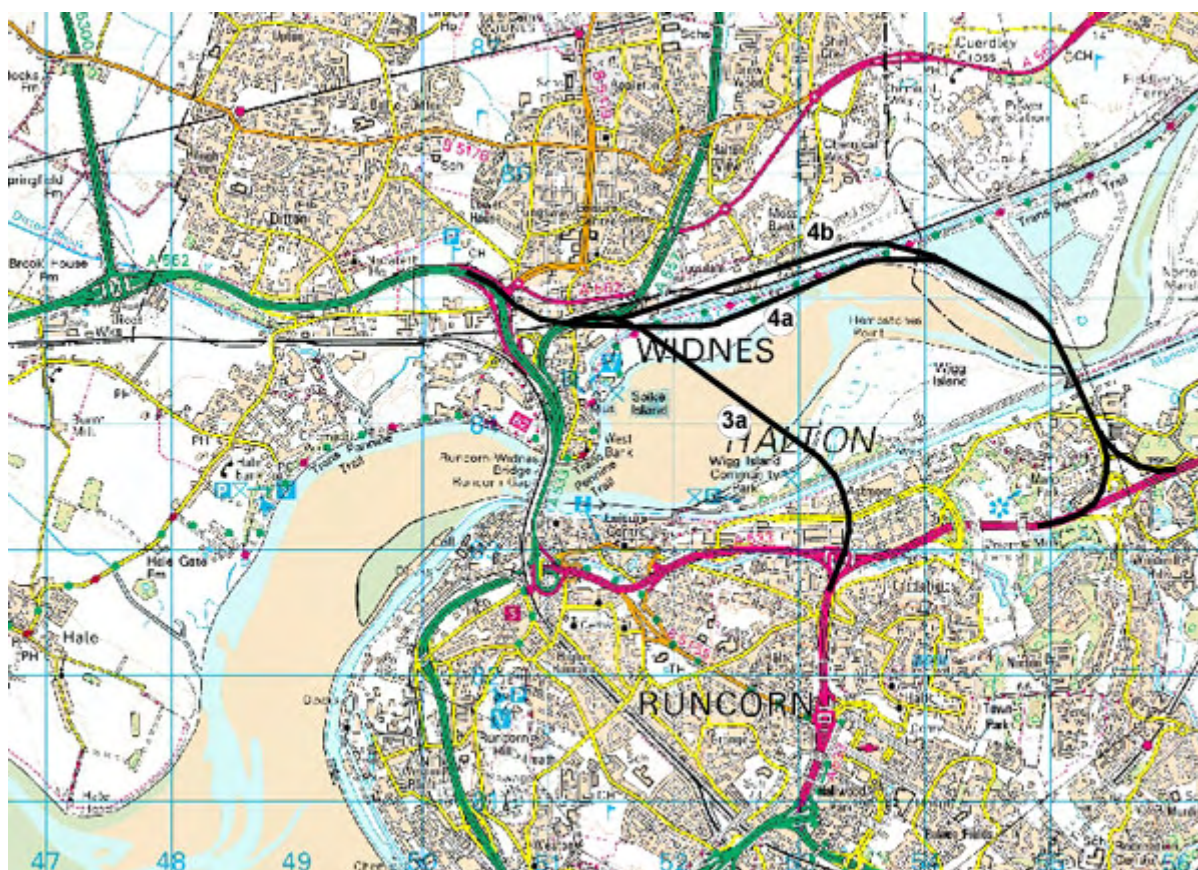
- 5.8.51 In summary, the fixed route alternatives in their current configuration were not considered to be feasible options to address congestion issues in Halton.

Refined Fixed Route Alternatives – Routes 4A and 4B

Description

- 5.8.52 Route 4, which was proposed by the Acting Mersey Conservator, does not sit comfortably in the existing road network. At its southern junction Route 4 would link with the A558 Daresbury Expressway, which has only been partially developed. Onward links to the south and to the M56 are extremely indirect and preference would depend upon whether travellers would wish to proceed east (towards the M6 / Manchester) or West (Chester and North Wales). Traffic studies have indicated that the majority would be likely to use the Central Expressway and Junction 12 on the M56. Some would route through Daresbury and M56 Junction 11.
- 5.8.53 On the north bank the links to the A562 (Liverpool Road) and the A557 (to St Helens and M62 Junction 7) would be long and difficult. For an initial comparison with other options, a simple link into south-east Widnes was shown which minimised the effect on Widnes Waterfront EDZ and avoided the most contaminated areas.
- 5.8.54 To address the traffic problems with Route 4, further developments were modelled, Route 4A and Route 4B. The change from Route 4 was to continue the route westwards along the north bank of the Estuary to join directly with the A562 Speke Road to Liverpool. As with other fixed route options a grade separated junction would be provided with the A557 Widnes Eastern Bypass connecting with the M62 (Junction 7) and St Helens. These additional alternatives are outlined below and shown in Figure 5.19.

Figure 5.19 - Route 4 Alternatives



- a. Route 4A progresses through the saltmarshes to the south of the St Helens Canal and crosses the canal and Ditton freight rail line once.
- b. Route 4B progresses north of the St Helens Canal and the freight line. This requires crossing the railway twice and maintaining the route at a much higher elevation. It would also occupy a significant proportion of the EDZ.

Discussion

- 5.8.55 Route 4A would have severe adverse effects on the saltmarshes with a significant area on the north bank lost. The effect on the tidal river would be much reduced by crossing at Fiddler's Ferry (although not entirely eliminated since there would be need for some works within the River to provide the base for the tower of the bridge). The sole advantage of keeping the route to the south of the St Helens Canal would be so that the vertical alignment of the new road could be brought down to canal-bank level and visual intrusion minimised.
- 5.8.56 Route 4B would not adversely affect the saltmarshes to the same degree (although this is still not insignificant, particularly along the edge of Cuerdley Marsh). However, the alignment would have to be maintained at a much higher level (approximately 11m above saltmarsh) in order to cross the Ditton Freight Line twice within a distance of approximately 1km and to facilitate the grade separated junction with the Widnes Eastern Bypass. The result would be a visual "wall" along the north bank isolating Widnes from the foreshore. The routes would also prevent a large proportion of the proposed development of the area (Widnes Waterfront EDZ) and would require the demolition of Rhodia works.

- 5.8.57 Routes 4A and 4B would not attract sufficient traffic from the SJB to permit that crossing to operate successfully as the local bridge with an enhanced provision for cycling and walking.
- 5.8.58 Although work undertaken as part of the MSA indicates that all options for Route 4 (4, 4A and 4B) would have a reduced effect on hydrodynamics of the Estuary in comparison to alternative fixed route bridge crossings, the adverse effects on saltmarsh habitats to the north of the River, the cost of the scheme due to its respective length and its effect on local businesses (within Widnes Waterfront EDZ) resulted in these alternatives being discounted.

Conclusion

- 5.8.59 Table 5.6 below provides a summary of those modified fixed route alternatives that were considered during the MSA process.

Table 5.6 – Summary of Refined Fixed Route Alternatives

Alternatives	Alternatives taken forward?	Explanation
Route 4A	x	Route 4A would have a severe adverse on the saltmarshes and therefore was not considered to be a feasible alternative.
Route 4B	x	Route 4B would prevent a large proportion of proposed development at Widnes Waterfront EDZ and would require the demolition of Rhodia Works, as such it was considered to be unfeasible.

- 5.8.60 In conclusion, the alternative that was considered to be the most feasible following the MSA analysis of all fixed route alternatives and associated modifications was Route 3A.

5.9 The Project – Design Alternatives

- 5.9.1 The following section explores design options which have been considered throughout the development of a new river crossing using Route 3A, which are the preferred alternative and the subject of this ES.

Tolling vs Non-Tolling Option

- 5.9.2 Original proposals for the preferred alternative, Route 3A, involved the development of an untolled scheme. Therefore, all assessment work undertaken, as summarised above proceeded on this basis. Following the submission of the MSA in 2003 the DfT requested additional information on a number of issues including the consideration of funding proposals by means of tolling. Studies undertaken concluded that without the tolling of both bridges (i.e. both the SJB and the New Bridge) transport distribution would be distorted and benefits associated with congestion relief not realised. It was therefore concluded that both bridges should be tolled. The MSA was re-submitted in 2004 providing detail of a tolled option for Route 3A. In March 2006 the DfT granted Programme Entry approval for the Project, along with conditions which were based on a tolled scheme. From this point onwards all further studies considered tolling.

Toll Plaza Locations at the North Junction

Description

- 5.9.3 During early stages of the Project, the scheme was constrained to tie back into existing alignment immediately west of Ditton Roundabout, and to avoid any significant encroachment into the area of St Michael's Golf Course. Consequently the main toll plaza had to be located on an elevated length of the scheme, east of Ditton Roundabout above the West Bank area of Widnes. During development of the Project reference design, constraints on land take around St Michael's Golf Course were relaxed, and alternatives for the location of the main toll plaza west of Ditton Roundabout were investigated. Two options were considered for the utilisation of land to the west of Ditton Roundabout.

Option One

- 5.9.4 Option one comprised the use of manual / semi-automated tolling plaza to the east of Ditton Roundabout. The bridge alignment crosses the St Helens Canal to the south of ThermPhos Chemical Works where the carriageway narrows from dual three to dual two as the slip roads for Widnes Eastern Bypass merge/diverge onto the main carriageway. The main line of the highway continues in an easterly direction on either embankment or viaduct towards Ditton Roundabout. As the carriageway passes above the rail freight line it widens to 40m to provide for a tolling plaza. To the west of the tolling area the carriageway narrows again to dual two and slip roads merge/diverge from the main carriageway onto Ditton Roundabout. The mainline crosses Ditton Roundabout on embankment or viaduct meeting Speke Road at existing grade to the west of Ditton Roundabout. The junction for Widnes Eastern Bypass is located between St Helens Canal and Victoria Road, this junction comprises a looped alignment.

Option Two

- 5.9.5 Option two comprises manual / semi automated tolling plaza located to the west of Ditton Road. The bridge alignment crosses St Helens Canal to the south of ThermPhos Chemical Works where the carriageway narrows from dual three to dual two as the slip roads for Widnes Eastern Bypass merge/diverge onto the main carriageway. The main line of the highway continues in an easterly direction on either embankment or viaduct over the rail freight line and Ditton Roundabout. The carriageway descends on embankment or viaduct to the west of Ditton Roundabout, at this point the carriageway widens to 40m for the tolling area at or close to existing grade. To the west of the tolling area the carriageway narrows to dual two and joins Speke Road, slip roads will be provided to link the tolling area with Ditton Roundabout.

Discussion

- 5.9.6 Each option for the development of this North Junction was considered against a number of objectives which included the following:
- a. Objective One: Minimise the visual effect of the Project within Widnes;
 - b. Objective Two: Minimise effects on public accessibility and severance within Widnes;
 - c. Objective Three: Develop a Project that offers value for money; and
 - d. Objective Four: Minimise environmental effects of the Project.
- 5.9.7 Work undertaken confirmed that Option Two was the preferred option to be carried forward as part of the Project for the following reasons.

- a. Option two would result in less visual effects than option one due to the reduced width of the structure to the east of Ditton Roundabout and the reduction in the elevation of the tolling area;
- b. The construction costs for option two would be less than those for option one;
- c. The transport efficiency for option one would offer better value than for option two. However, the introduction of east facing slip roads at Ditton Roundabout would deal with such transport efficiency issues associated with option two making it feasible;
- d. Costs associated with land acquisition are considered to be less for option two as option one would require longer structures over Ditton Rail Freight Line and Victoria Road;
- e. Option one would raise additional traffic management issues when compared to option two; and
- f. Although both options may require remediation of contaminated land, contamination investigations indicate that any costs / risks associated with this would be manageable.

Span and Arrangement Alternatives

5.9.8 Throughout the development of Route 3A as the preferred alternative a number of alternative span and arrangement options were considered for its construction. Each of these is outlined below together with reasons for their adoption / exclusion. These alternatives include:

- a. Short span – viaduct 100 metre span;
- b. Single span; and
- c. Cable stayed crossing (medium span).

Short Span - Viaduct 100m span - Description

5.9.9 The arrangement layout for the short span option has eleven sets of piers within the main intertidal area of the Estuary and eight sets of piers within the saltmarsh (Figure 5.20). For this arrangement, a hydrodynamic model was run to determine its effect on processes within the Estuary (refer to Chapter 7, Appendix 7.4 and 7.7 for further information).

Figure 5.20 - Short Span Pier Arrangement



Discussion

- 5.9.10 From the modelling, the effect on the morphology of the Estuary as a result of this bridge arrangement extended beyond the confines of Runcorn Gap to the extent of the Upper Estuary in the downstream direction and beyond Fiddlers Ferry in the upstream direction. The model used the 2002 bathymetry as the basis for comparisons and the results were derived from model runs with and without the bridge, using the tidal flows of a spring-neap tidal cycle to induce morphological change.
- 5.9.11 In summary the results showed that this bridge arrangement had the greatest effect on the long-term morphology of the area of those alternatives considered and had the greatest potential to alter the locations of the low water channels. Erosion around the towers was predicted to reach depths of up to 1.48m by the end of the first year of operation. Similar levels of sediment accretion (1.79m) were predicted in the lee of bridge piers. These morphological changes were significant in that they extend downstream of the Runcorn Gap and also affected the training structure associated with the Manchester Ship Canal. Overall it was predicted that over 18% of the study area would change morphologically as a result of this pier arrangement.
- 5.9.12 The spatial extent and severity of the predicted impacts for the short span arrangement during the operational phase were such that this design option could not be recommended. In addition, the short span was predicted to have an effect on the morphology of the Runcorn Gap. Given this and the threat this poses to the Natura 2000 sites and SSSI designations, it was concluded that this arrangement would not be taken forward.

Single Span Option - Description

- 5.9.13 To reduce the hydrodynamic effects on the Estuary (no towers situated within the tidal Estuary) a single span option of 1000m would be required. This would be possible by suspension bridge or cable-stayed.

Discussion

- 5.9.14 The advantage of the cable-stayed option is that it is relatively simple to build and it is economic. However, the towers for such a bridge would have to rise to 200m above deck level putting the tower tops at an elevation of approximately 140m above ordnance datum (AOD). Initial consultation with Liverpool John Lennon Airport confirmed the location of controlled airspace in the vicinity of the Project. This restricted any structures so as not to exceed 174m AOD. Thus, a 1000m span cable-stayed structure was not considered to be an option.
- 5.9.15 A suspension bridge, would require towers approximately 125m high above the deck level i.e. top of tower approximately 165m AOD. This does not intrude into the initially confirmed Liverpool John Lennon Airport airspace of 174m AOD and therefore would be considered acceptable. The disadvantage of pure suspension bridges is their flexibility (making them unsuitable for rail traffic) and their cost. They tend to be rather slow to build since construction is entirely sequential in process and they have limited construction faces.
- 5.9.16 An alternative is a hybrid structure. This combines a suspension bridge with a cable-stayed bridge. The end lengths of the main span would be cable stayed and only the central 500m or so would be pure suspension bridge. The result is shorter towers (approximately 130m tall – 160 to 170m AOD) and multiple working faces (units can be added to cantilevers progressing from either tower while deck units are being lifted in the centre).
- 5.9.17 It should be noted that subsequent to the above assessment, Liverpool John Lennon Airport has confirmed that controlled airspace would restrict structures to 150m AOD rather than 174m AOD as initially required. This does not have an effect on the above assessment, instead providing further reasons as to why a suspension bridge would not be a feasible alternative i.e. it would also intrude on the Airport's controlled airspace.
- 5.9.18 The curved approach spans limit the opportunity to anchor the back stays to the towers in the deck. Independent anchor blocks would therefore need to be formed within the saltmarshes on each bank. To develop the necessary capacity to withstand the large anchorage forces will require massive concrete monoliths approximately 20m by 40m in plan area. These would be hollow concrete structures incorporating stressing galleries for the back stay cables, and would need to develop the necessary ground resistance to prevent the anchorage sliding towards the River.
- 5.9.19 The cost of a long-span structure has been estimated to be considerably more when compared with a 3-tower alternative reflecting the engineering complexity of constructing such a structure.
- 5.9.20 The effect on the Estuary would be reduced by crossing using a single span bridge, although not entirely eliminated since there would be a need for some works within the Estuary to provide the base for the tower of the New Bridge. However, the destruction of saltmarsh would be extensive with a significant area being lost due to the requirement of these anchor blocks.
- 5.9.21 In conclusion the hybrid single-span option was discounted on economic grounds and the single-span bridge option was discounted due to its unacceptable effects on the saltmarshes.

Cable Stayed Crossing - Description

- 5.9.22 An acceptable compromise was believed to be provided by a cable stayed crossing of the inter-tidal Estuary with maximum clear spans of approximately 360m i.e. a medium span compared to the other options considered. This would require between two and four supporting towers to be constructed within the main Estuary and piers for approach structures within the saltmarshes.
- 5.9.23 Alternative arrangements for the number and locations of towers within the main Estuary were considered for this cable stayed option. Detailed modelling (refer to Chapter 7, Appendix 7.4 and 7.7 for further information) was used to assess the effects of each of these. These medium span alternatives included the following:
- a. Four towers and piers;
 - b. Four towers and piers (revised) – towers moved laterally to reduce their proximity to the region where the low flow channels most commonly occur;
 - c. Three towers and piers; and
 - d. Three towers and piers (revised) – piers at the northern and southern edges of the saltmarshes have been brought landward and the three tower positions have been relocated slightly as a result.
- 5.9.24 The hydrodynamic modelling for these alternatives used the 2002 bathymetry and a spring-neap tidal cycle to assess the morphological changes that would occur for each of the alternatives. In addition, an extreme event involving a tidal surge and extreme fluvial flood was modelled for certain alternatives. For each case, a comparison was made between the effects on morphology of the proposed bridge structure and the changes in the Estuary morphology that would occur naturally under the same event conditions without the bridge in place.

Medium Span Four Tower and Pier Arrangement Option

- 5.9.25 For this arrangement there were four towers with footings in the main Estuary and four sets of piers located on the saltmarsh areas (as shown in Figure 5.21). The hydrodynamic model was run for a spring-neap cycle and results were derived to indicate effects on water levels, near-surface and near-bed speeds and bed shear stress. The morphological model was run using these results to predict the likely long-term (one year period) changes as a result of this arrangement within the system with regards to patterns of erosion and deposition.

Figure 5.21 - Medium span four tower and pier arrangement



Medium Span Four Tower and Pier Arrangement (revised)

- 5.9.26 In this alignment there were four towers and footings in the main Estuary and four sets of piers located on the saltmarsh areas, although the towers were moved laterally out of the region where the low flow channels most commonly occur (as shown in Figure 5.22).

Figure 5.22 - Medium span four tower and pier arrangement (revised)



Medium Span Three Tower and Pier Arrangement Option

- 5.9.27 For this arrangement the number of towers was reduced to three with footings in the main area (as shown in Figure 5.23). The pier arrangements within the salt marsh area were also modified and there are ten sets of piers located in saltmarsh areas.

Figure 5.23 - Medium span three tower and pier arrangement



Medium Span Three Tower and Pier Arrangement (Revised) Option

- 5.9.28 For this arrangement the position of the three towers and sets of piers were modified. The piers at the northern and southern edges of the saltmarsh areas were moved landward and the three tower positions were relocated slightly as a result of the pier repositioning (as shown in Figure 5.24).

Figure 5.24 - Medium span three tower and pier arrangement (revised)



Discussion

- 5.9.29 Both the original four and three tower options were predicted to have a lesser effect on the Estuary system in comparison to the short span option (detailed above). However, due to the proximity of the towers to the region where the low flow channels most commonly occur, in both these arrangements, it was predicted that there would be an increase in erosion and deposition.
- 5.9.30 There was little distinction between the effect from the original and revised four tower arrangements and close to the bridge piers the levels of erosion and deposition are similar. Modelling results indicated that both four span options would have a negative effect on the morphology of the Runcorn Gap and therefore pose a threat to the downstream protected habitats of the Natura 2000 and SSSI designations. It was therefore concluded that neither of these arrangements should be taken forward.
- 5.9.31 The original three tower option had the greater effect, altering morphology of over 13% of the study area and inducing scour holes to a depth of 1.46m and deposition of 1.79m in the vicinity of the towers. There was a dramatic difference between the effects of the original three tower option when compared to the revised three tower option where there was only 4% of the study area affected by the tower and pier arrangements.
- 5.9.32 Based on the conclusions of the modelling the revised three span option was taken forward for the Project arrangement.

5.10 Construction Alternatives

- 5.10.1 A range of alternative construction methods were explored to ensure that unacceptable environmental effects were not caused during the construction phase of the Project. Based on this assessment a number of construction methods were discounted due to their negative effects on the Natura 2000 and SSSI sites downstream of the SJB. These methods are outlined below. The CMR (Appendix 2.1) provides a summary of those construction methods taken forward for assessment in the EIA.
- 5.10.2 A number of alternative construction methods, focusing on access across the saltmarshes, sandbanks and main channel, were considered for the construction of the Project. These included the following options:
- Half Tide Causeway – for access across the saltmarshes to access the intertidal zone at the tower locations;
 - Dredged Channel – to allow barges to access construction areas; and
 - Islands – to allow access around the cofferdams via hovercraft and platforms.

Half Tide Causeway

Description

- 5.10.3 A half tide causeway would comprise a stone track over the sandbanks to gain access across the Estuary to the tower areas. It would be covered by water on the higher tides. The drainage function of the River would be preserved by leaving the South Channel open and by the provision of lateral, large diameter pipes within the causeway at the location of the North Channel. A half-tide causeway would require approximately 12,000 m³ of graded stone to be imported. This stone would be back-tipped from the end of the already constructed causeway and placed in a Reno mattresses and on a geotextile membrane below the main causeway by earthwork plant (excavator and dozer). During the period when this temporary 'half tide' causeway is in place, navigation along this stretch of the estuary would only be possible in the South Channel. Following completion of the works the 'half tide' causeway would have to be excavated and removed from site to an approved tip or sold to a future user.
- 5.10.4 A half-tide causeway was considered for access to construction areas across the sandbanks and within the intertidal zone. The half-tide causeway would extend from the northern bank across the Estuary to the southern-most tower and would be constructed on the downstream side of the New Bridge alignment. In addition to the half-tide causeway, 30m diameter cofferdams would be constructed at each of the three tower positions.
- 5.10.5 The half-tide causeway would link up to the temporary causeway proposed across the saltmarsh on the northern bank to provide a construction road access to the three tower positions from the construction compounds, and materials and equipment delivery point, on the Widnes side of the Project.
- 5.10.6 The half-tide causeway would provide a 10m wide access haul road set at a level of 2.6m AOD. It would be overtopped by water on each tide for varying periods, depending on the specific tide.

Discussion

- 5.10.7 The half-tide causeway was added to the hydrodynamic model undertaken for the EIA. Thus the scale and spatial extent of the effects associated with this type of construction access arrangement were assessed.

- 5.10.8 The sediment movements within the Estuary are dynamic and the forces acting are extremely powerful. However, based upon the series of topographic surveys undertaken in the Hydrodynamics Study Area (Chapter 7), there appears to be relatively little change in the total volume of sediment movement year on year and it is assumed therefore that some dynamic equilibrium exists in the area.
- 5.10.9 It should be noted that the basis of the modelling is that the Estuary is generally in a state of dynamic equilibrium. If this equilibrium is disturbed, then the spatial extent and scale of effects could be more extensive than that predicted by the modelling. Given the spatial extent of the predicted effects and the increases in parameters such as bed shear stresses, then an effect on this equilibrium is likely. This could in turn lead to a change in the long-term sediment volume moving within the Estuary and the total volume of material resident in the Estuary. This would cause changes to the morphology of the area, affect the level of flood risk locally, and potentially have more widespread effects on sediment dynamics within the Estuary as a whole.
- 5.10.10 The results of the hydrodynamic modelling indicate that the spatial extent of the changes to the modelled parameters extend for some distance downstream of Runcorn Gap and also upstream passed Fiddler's Ferry to the tidal limit at Howley Weir, near Warrington. This has implications for the wider management of the Estuary, the SPA and other designated sites, and other landowners whose property includes a section of Estuary frontage.
- 5.10.11 The modelled effects of the half-tide causeway include:
- An increase in the tidal range in the Estuary at certain locations, caused by the impounding effect of the causeway;
 - A slight increase in predicted high water level (even though extreme tidal surge events were not included in the modelling);
 - A significant increase in peak flood and ebb water velocities, notably in the vicinity of the existing bridges at Runcorn Gap and also along the inter-tidal zone edge. In Runcorn Gap the increase is up to 55% on a spring tide with water velocities predicted to reach a velocity of 2.8m/s;
 - Predicted changes in surface speed extend downstream to Hale Head and upstream to the tidal limit;
 - Conversely, tidal velocities are significantly reduced in some areas. For example there is a 30% reduction in velocity in the Estuary adjacent to Fiddler's Ferry Power station which could lead to increased sedimentation in this area;
 - The changes in velocity have a direct effect on predicted bed shear stresses and the increases have a significant effect on the rate of erosion and scour to existing structures. The changes in bed shear stress affect areas immediately adjacent to the causeway as would be expected but also the existing bridge footings and Randle Sluices;
 - Although the existing bed shear stresses cause bed material to be taken into suspension, the higher bed shear stresses predicted from the causeway option would almost certainly lead to a general increase in the rate of erosion as the stresses would more easily erode the compacted, deeper sediments.
- 5.10.12 It is clear from the modelling results that the half-tide causeway has significant detrimental effects on the morphology of the Estuary in the area studied. These are far more extensive than anything predicted previously and extend well beyond the limits of the Upper Estuary, impacting downstream of Hale Head and upstream to the tidal limit.
- 5.10.13 The predicted increased water velocities through Runcorn Gap present a significant increase in the potential erosion and scour to the foundations of existing structures. The structures include both existing bridges in Runcorn Gap, Randle Sluices and the training works to the Manchester

Ship Canal. The security of these foundations subjected to such increases in erosion would need to be checked and agreed with the relevant authorities.

- 5.10.14 There is also an effect on the navigation of the Estuary and particularly vessel passage through Runcorn Gap. The predicted increase in water velocity is significant and would be a concern to the masters of small yachts and pleasure craft.
- 5.10.15 There are also some significant construction issues in placing, maintaining and removing the half-tide causeway. The use of culverts to permit flow along the line of the former northern channel would be very difficult to maintain. The low threshold for the onset of suspension of bed materials means that the bed is easily disturbed and would provide a very poor foundation for the temporary culvert structure. Culverts would move and settle, rapidly infilling and losing their flow capacity. A similar problem would occur with the causeway itself, particularly as the tide begins to flow over the surface on the flood tide; erosion and scour protection measures would be needed to the sides of the causeway. Additional specific measures would be needed at the southern end of the causeway to prevent continual erosion adjacent to the southern channel.
- 5.10.16 In summary, given the spatial extent of the predicted effects, the increased risk to existing structures, the uncertainty of the long-term effects on the morphology of the Estuary and the practical difficulties and potential effects on morphology during the construction period from the construction and maintenance of the half-tide causeway, this construction option is not recommended. Consequently, this alternative was not taken forward as an option.

Dredged Channel

Description

- 5.10.17 A dredged channel was considered to allow barges access to construction areas. It has been assumed that a suction-dredger and self-propelled barges would be used to undertake the dredging operations. Dredging would be used to create a temporary channel to provide access to the three tower positions and along the line of the New Bridge to enable units to be lifted vertically into place. The channel would need to extend to the point where the construction barges would be loaded with bridge units and other construction materials and equipment. This is assumed to be at the Old Lock on the Manchester Ship Canal.
- 5.10.18 Additional dredging would be needed across the Estuary from the Old Local to Spike Island on the northern bank to provide means to transfer materials and equipment to this side of the Estuary.

Discussion

- 5.10.19 The dredging option was considered based on experience of such operations in various ports, and thus the scale and spatial extent of the effects associated with this type of construction access arrangement were assessed. This assumed the use of self-propelled barges of 35m length, 10m beam and a 3-4m laden draught in their assessment.
- 5.10.20 In order to create a navigable channel, sufficient allowance must be made for safe manoeuvrability of the barges in both laden and unladen condition. This sets requirements for the width of the channel and for the dimensions of turning and passing areas. A minimum bend radius of 350m would be required and that turning areas would need a diameter of 140m at full dredged depth.

- 5.10.21 In addition, the material in the Estuary would influence the angle of the side slopes of the dredged areas. Based upon the information available from site investigations, this angle would be about 28 - 30° and would thus extend the width of dredging well beyond the required channel dimension.
- 5.10.22 Based on these dimensions and the proposed dredged channels a dredged volume of sand and silt up to 750,000m³ can be estimated. This excludes any necessary dredging downstream of Runcorn Gap.
- 5.10.23 The existing channel would also need to be dredged downstream of Runcorn Gap. This is necessary to provide sufficient depth of water for the dredger and the self-propelled barges to gain access to the construction area. Evidence gained during site investigations in the Estuary in the summer of 2007 is relevant. The tug abandoned attempts to manoeuvre the jack-up barge upstream from Hale Head, a point some 6km downstream of Runcorn Gap. The required depth of water for the safe passage of the dredger and an unladen self-propelled barge is uncertain but in fully laden conditions barges are likely to require a similar depth of water to that of the tug, perhaps 4m or so. It is possible therefore that the existing channel would need to be dredged for 6km downstream of Runcorn Gap.
- 5.10.24 The effect of the permanent removal of this quantity of material from the sediment system within the Estuary as a whole has not been assessed. It was assumed that the dredged material would be stored locally and be re-introduced into the Estuary as soon as construction activities would allow. Land would need to be made available for this and the dredged material would need to be screened for any contamination. Whilst it is believed that, at the bridge tower locations, the risk from the presence of contaminated sediments is low, this cannot be assumed for the much larger areas that would be exposed from a dredging operation of the scale required for this option.
- 5.10.25 In addition to the estimate of the quantity of material to be dredged to create the required channels, dredging would also be needed to maintain these channels throughout the construction period. Given the evidence that has been collected from the aerial photographic record of morphological change, it is clear that the Estuary in the area of the proposed bridge is highly mobile. Maintaining the dredged channels would be problematic and would require constant attention. This would substantially increase the amount of material to be dredged and stored during the construction period.
- 5.10.26 A FEPA licence would be required for such dredging operations and this would require detailed sampling of the material to be dredged. Whilst some limited results are available from the Estuary site investigation, the majority of sample points are not within the areas to be dredged nor have these samples necessarily been tested for the range of parameters needed for the licence application. Further sampling and analysis would therefore be required.
- 5.10.27 The effect of the proposed dredging on the invertebrate and vertebrate populations of the Estuary sands and silts has not been undertaken. However, the scale of dredging proposed would clearly impact significantly on these populations (based upon the area that would be affected). In addition it is uncertain how quickly or completely these populations would re-establish once the material was re-introduced into the Estuary.
- 5.10.28 The hydrodynamic effects of the dredged channels in the Estuary have not been modelled. However, given the results of the effects for the half-tide causeway it can be safely assumed that the effects of the dredged channels would be significant and spatially significantly more extensive than those indicated for either the permanent bridge structure or the piled jetty form of construction. The assessment and consultation with land owners would therefore need to include these larger areas of effects.

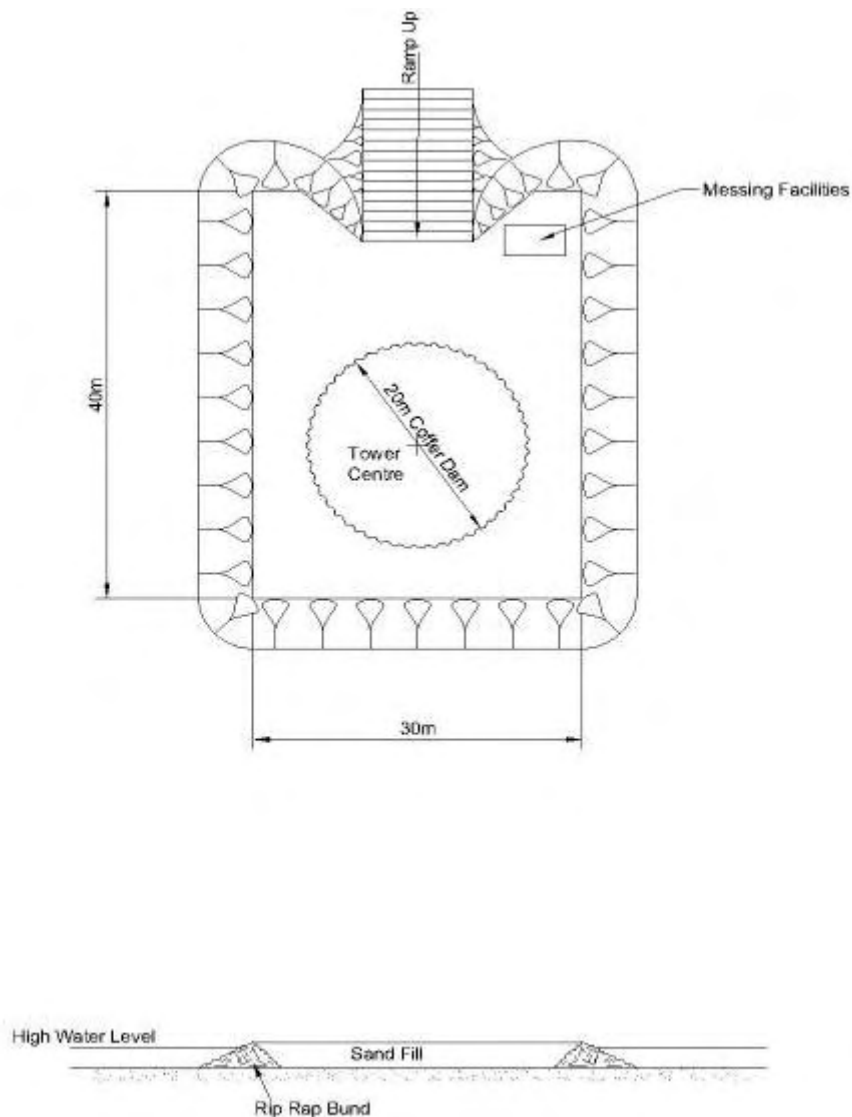
- 5.10.29 The ecological effects on these wider areas would also need to be assessed. Since the hydrodynamic and sediment movement effects would include the downstream designated sites (Natura 2000 Sites and SSSI), the assessment required is likely to be more extensive and time consuming given the seasonality of the ecosystem affected.
- 5.10.30 The scale and extent of effects from the dredging option are potentially considerable. In order to quantify these, a considerable amount of uncertainty exists. Due to the spatial extent of these effects and practical difficulties of the maintenance dredging required (assuming that the channels can be dredged successfully), this alternative was not taken forward.

Island Construction Option

Description

- 5.10.31 Three temporary islands were considered (approximately 60m x 58m when allowance for embankments and access are included) to accommodate the cofferdams and act as access areas for the construction of the three towers (as shown in Figure 5.25). Access to these islands would be via hovercrafts and hover platforms as deep draught vessels would not be able to access these locations except on a limited number of tides. On completion of the towers and main bridge elements, these islands would be removed. Jetties would also be built across the salt marsh extending to the locations of the piers adjacent to the outer towers.
- 5.10.32 This construction option was simulated to represent a period of 18 months in the modelling.

Figure 5.25 - Construction Option – Island Method



- 5.10.33 For this construction option, the hydrodynamic model was run for a spring-neap cycle and results were derived to indicate impacts on water levels, near-surface and near-bed speeds and bed shear stress. The morphological model was also run to predict the likely long-term (eighteen month period) changes as a result of this construction option within the system with regards to patterns of erosion and deposition

Discussion

- 5.10.34 The effect on the morphology of the Estuary as a result of this crossing arrangement is not confined to the Upper Estuary (between Runcorn and Fiddlers Ferry) during the eighteen month period predicted by the model.
- 5.10.35 This construction option has the potential to alter the locations of the low water channels. Downstream of the New Bridge there is a trend of increased erosion along the interface of the south low water channel and the intertidal areas (typically 0.4m to 0.1m deep) and deposition in the north low water channel (typically 0.2m to 0.1m of sediment). These changes in the low

water channels extend in to the Estuary upstream and downstream of the New Bridge and beyond the boundaries of the study area into the Runcorn gap. Adjacent to the piers erosion is predicted to reach depths in the order of 1.18m and sediment accumulation in the order of 0.6m. The intertidal areas on the interface of the northern edge of the north channel and the southern edge of the south channel upstream of the New Bridge locations and in the centre of the channel are also subject to deposition in the order of 0.1m.

5.11 Summary

- 5.11.1 Table 5.7 provides a summary of those alternatives taken forward as part of the Project and an indication of those which have been discounted throughout the Project's development. It can be seen that the Project in its current form (as outlined in detail in Chapter 2) is the preferred alternative and as such is the subject of this EIA.

Table 5.7 - Assessment of Alternatives – Results

Alternative	Description	Alternatives taken forward?
DOT Alternatives (1992/1993)	12 alternatives narrowed down to the following five alternatives: - Speke to Hooton; - M57 – A562 link road to Frodsham; - M57 – A562 link road to Runcorn West; - Runcorn to Widnes Bridge; and - Widnes Eastern Bypass – Runcorn.	x
Mersey Crossing Group Study (Stage 1, 1997)	Option A	✓
	Option B	✓
	Option C1	x
	Option C2	x
	Option D	x
	Option E	x
	Option F	✓
	Option G	✓
	Option H	x
Mersey Crossing Group Study (Stage 2, 1999)	Options A, B, F and G	x
Review of Options (1999)	Option 1A	✓
	Option 1B	✓
	Option 1C	✓
	Option 2	x
	Option 3	x
	Option 4	x
	Option 5	x
Integrated Transport Solutions (2000)	Astmoor to West Albright & Wilson	x
	Astmoor to East Albright & Wilson	✓
	Central Expressway to West of Albright & Wilson	x
	Central Expressway to East of Albright & Wilson	x
Major Scheme Appraisal Options		
Policy Instruments	Halton Travel Plan	x
	Charging for Using the Existing Bridge or Other Roads	x
	Dynamic Lane Management	x
	Selective Access by Vehicle Tagging	x
Infrastructure Improvements	Road Space Re-Allocation	x
	Park & Ride	x

Alternative	Description	Alternatives taken forward?
	Rail Service Improvement	x
Infrastructure Developments	Bridge to the West of the Railway Bridge	x
	Fixed Crossing between the SJB and the Railway Bridge	x
	Tunnels	x
	New Bridge Adjacent to or East of the SJB	✓
Fixed Routes	Route 1	x
	Route 2	x
	Route 3	x
	Route 4	x
Refined Fixed Routes	Route 2A	x
	Route 3A	✓
	Route 4A and 4B	x
Tolled vs Untolled	Untolled Route 3A	x
	Tolled Route 3A	✓
Design Alternatives		
North Junction Tolling Area	Option one	x
	Option two	✓
Span Options	Short Span	x
	Single Span Option	x
	Cable Stayed Option	✓
Design Arrangements	Four towers and piers	x
	Four towers and piers (revised)	x
	Three towers and piers	x
	Three towers and piers (revised)	✓
Construction Alternatives		
Access Alternatives	Half-tide Causeway	x
	Dredged Channel	x
	Islands	x

5.12 References

- Ref 1 Halton Borough Council, 2006. Regeneration Statement: Widnes and Runcorn. Edition 6: Autumn 2007.