8 COMPARATIVE ROUTE APPRAISAL

8.1 Introduction

In addition to the Scheme Appraisal methodology discussed in previous chapter, it was felt that a quantitative appraisal method should also be carried out as part of the study. Therefore, each route option was assessed against various criteria, which fell under three main categories of Engineering, Economic and Environmental. Points are awarded on a seven point scale for each criteria:

+3 = largely beneficial
+2 = moderately beneficial
+1 = slightly beneficial
0 = neutral
-1 = slightly adverse
-2 = moderately adverse
-3 = largely adverse

The methodology for scoring the options in the three main categories is described below.

8.2 Engineering Route Appraisal

Route options were assessed against eight engineering criteria: geometry; drainage; structures; buildability; services; earthworks; construction cost; and property take. For each engineering criteria, options were compared against existing conditions. Therefore, only geometry could considered beneficial, as the standard of carriageway proposed would be an improvement on existing conditions. All other criteria scored adversely, as construction of the new carriageway will incur costs and cause disruption.

8.2.1 Geometry

The geometry is based on two factors, the standard of geometry provided and the overall alignment of the route. Firstly, each route was scored with regard to compliance with DMRB TD 9/93 'Highway Link Design'. All proposed route options have at least desirable minimum geometry, therefore were considered slightly beneficial. Options, which have straighter alignments, were considered moderately beneficial, and a straight alignment would be largely beneficial. This consideration was tempered by TD 9/93 Chapter 8, which advises that the horizontal and vertical alignment of an all-purpose dual carriageway should follow the topography, as much as possible, without purposely achieving a "motorway" type of flowing alignment.

All options scored +1 as they have desirable minimum geometry. Options 4, 6 and 7 scored +2 as they have better than minimum geometry, the minimum horizontal curve provided is 2880mR.

Scores allocated for the standard of geometry were then marked up, down or neutral, according to the overall alignment and driver's perception of the route. This aims to assess the 'directness' of an alignment. For example, an alignment which links two points in a straight line, should score better than a route which snakes between two points, but which still has compliant geometry. All alignments are considered beneficial compared to existing A6, with alignments 6, 7, 8 scoring best as they pass south of Moneynick in one long continuous arc, therefore having best tie-in with adjacent Toome bypass and M22, and a good overall flowing alignment.

Overall scores allocated for geometry combine these two factors and are listed below.

Geometry	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Geometry	+1	+1	+1	+2	1	+2	+2	+2
Alignment	0	0	0	0	0	+1	+1	+1
Score	+1	+1	+1	+2	+1	+3	+3	+3

8.2.2 Drainage

This criterion assesses the ease with which the surface run-off can be drained from the carriageway based on the vertical profile developed and the frequency of outfalls along the route. Options that have flatter profiles or those which would require false embankment, scored poorly. Options that have a varied profile and would drain 'naturally' scored better. It should be noted that preliminary vertical designs have been developed based on current ground topography information.

The overall drainage score is based on the average of profile and outfall scores. Options with no drainage issues are neutral and scored 0.

Drainage	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Profile	-1	-1	+2	-1	-1	-2	-2	-2
Outfalls	+2	+2	+2	+2	+2	+2	+2	+2
Average	*+1*	*+1*	*+2*	*+1*	*+1*	*0*	*0*	*0*
Score	-1	-1	0	-1	-1	-2	-2	-2

8.2.3 Structures

Structure assessment scoring was based on structure cost estimates, which reflects the number, size and complexity of structures required for each route option compared to the average for all the route options. It has been assumed that no scheme could be beneficial. Consequently, schemes with no structures costs would score 0, those with less than average scored –1. Further increments of £1,000,000 were used beyond the average.

Structures Score	Structures Cost banding
0	£0
-1	£1 to £average
-2	£average + £1M
-3	(£average + £1M) +

Structures	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-2	-2	-1	-2	-2	-1	-1	-1

8.2.4 Buildability

Buildability assesses the traffic management implications of constructing each option. As well as delays to the road user during the construction process, online options will incur greater traffic management costs compared to offline options. Extensive traffic management and temporary diversions are required to allow construction adjacent to live carriageways, which restricts site access and working area. Therefore, online options score poorly. No option scores positively, as offline options would require some traffic management at tie-ins and where constructions intersects with the existing road network.

Buildability Scoring	Online widening or offline
0	Offline
-1	Majority offline
-2	Offline/online
-3	Majority online

Buildability	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-1	-1	-2	0	-1	-1	0	0

8.2.5 Services

The services criteria assesses the impact each of the route options will have on services owned by the public utility companies. The assessment was based on information received from the public utility companies. It has been assumed that all options are disruptive to some extent, including those offline options. Therefore, at best, a route would score –1 to account for diversions at tie-ins. Online options scored –2 and options which would have a major impact on apparatus scored –3.

Services	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-1	-1	-2	-1	-1	-1	-1	-1

8.2.6 Earthworks

The earthworks criteria considers the extent of earthworks associated with each scheme. The earthworks cost for each option is compared to the average of all route option earthworks costs, and scoring is based on the amount by which individual earthworks costs deviate from the average. It has been assumed that no scheme could be beneficial. Consequently, those with no earthworks costs scored 0, those with less than average score –1. Further increments of £500,000 were used beyond average. It should be noted that earthworks costs are based on volumes taken from preliminary vertical designs based on current ground topography information.

Earthworks Score	Earthworks Cost banding
0	£0
-1	£1 to £average
-2	£average + £0.5M
-3	(£average + £0.5M) +

Earthworks	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-1	-1	-1	-2	-1	-2	-2	-1

8.2.7 Construction Cost

The construction cost criteria assesses the estimated pavement cost only, therefore is a reflection of total route length, and proportion of route online. All other construction costs (services, structures, earthworks etc) are covered under other engineering criteria.

The pavement cost for each option is compared to the average of all route option pavement costs, and scoring is based on the amount by which individual pavement costs deviate from the average. It has been assumed that no scheme could be beneficial. Consequently, those with no pavement costs scored 0, those with less than average score –1. Further increments of £1,000,000 were used beyond average.

Pavement Cost Score	Pavement Cost banding
0	£0
-1	£1 to £average
-2	£average + £1M
-3	(£average + £1M) +

Construction Cost	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-2	-1	-1	-2	-2	-1	-2	-2

8.2.8 Property Take

The property take criteria assesses the impact each of the route options would have on existing residential and commercial properties and approved planning applications. It should be noted that these figures are based on current mapping which was produced in 1997. Scoring as listed below was based on the total number of properties and approved applications falling within a corridor wide enough to accommodate a D2AP carriageway cross section. Scoring is limited to 0 through to –3, as no property take was considered to be neutral, and any property take was considered to be adverse.

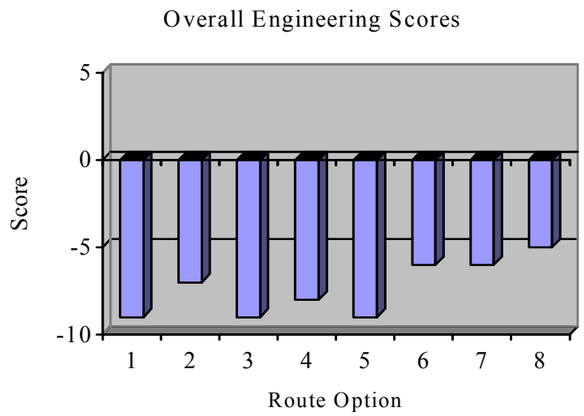
Property Score	Property Take
0	no properties/approved applications
-1	1 to 8 properties/approved applications
-2	9 to 16 properties/approved applications
-3	17 to 24 properties/approved applications

Property	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Existing Property	8	2	14	12	9	1	2	6
Approved Planning Applications	3	3	3	2	2	1	0	0
Score	-2	-1	-3	-2	-2	-1	-1	-1

8.2.9 Overall Engineering Scores

Each of the scores from the eight individual engineering criteria were added together to derive the total engineering scores for each route option. This aggregated score gives and overall assessment of the impact the construction of each route option would have. The results of the engineering scheme assessment are listed below in tabular and chart form.

Randalstown	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Geometry	1	1	1	2	1	3	3	3
Drainage	-1	-1	0	-1	-1	-2	-2	-2
Structures	-2	-2	-1	-2	-2	-1	-1	-1
Buildability	-1	-1	-2	0	-1	-1	0	0
Services	-1	-1	-2	-1	-1	-1	-1	-1
Earthworks	-1	-1	-1	-2	-1	-2	-2	-1
Construction Cost	-2	-1	-1	-2	-2	-1	-2	-2
Property Take	-2	-1	-3	-2	-2	-1	-1	-1
Total	-9	-7	-9	-8	-9	-6	-6	-5



8.3 Environmental Appraisal

Route options were assessed against twelve environmental criteria: air quality; cultural heritage; disruption due to construction; ecology & nature conservation; landscape & visual; land use; traffic noise & vibration; pedestrians, cyclists, equestrians & community effects; vehicle travellers; water quality & drainage; geology & soils; and policies & plans. For each environmental criterion, options are compared against existing conditions. Hence from an environmental perspective, which includes both physical and human attributes, some aspects will score positively, i.e. a benefit over the existing situation, whereas other aspects will score negatively, i.e. a disbenefit over the existing situation. The scoring methodology for all environmental criteria is described below.

8.3.1 Air Quality

This aspect considers the total number of properties that would be within 200 metres of both the existing route and proposed route options. It also considers the number of sensitive locations (schools, elderly person homes, community facilities etc.) and their proximity. Where there would be a reduction in the number of properties affected and a reduction in the number of sensitive locations in proximity to the route, the route option scores positively.

The central corridor route options would have the greatest number of properties within 200m of any of the three corridors. Of these, option 5 would have the greatest impact with most properties within 200 metres of the alignment. The south corridor would impact on the fewest number of properties, with option 8 having the least impact overall. All proposed route options would have fewer properties within the 200m band when compared to the existing route.

Air Quality	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	1	1	0	1	1	1	2	2

8.3.2 Cultural Heritage

Cultural Heritage considers potential direct impacts on listed buildings, industrial archaeology and known archaeological sites due to route option alignments. It also considers the implications on National Trust inalienable land and defence heritage sites. As there is potential to affect as yet undiscovered archaeological sites, all route options scored negatively. Where there would be the direct loss of a known cultural heritage site or sites, depending on the scale of impact, the route option scores up to –3.

There are very few cultural heritage sites within the study area. The south corridor would have the least impact, with route option 7 directly affecting an archaeological heritage site. Route options 6 and 8 would not directly affect or come close to any documented cultural heritage sites. The central corridor would have the greatest impact, with route option 3 directly affecting two cultural heritage sites and coming within 50 metres of two other sites. By slight realignment of the various route options, some if not most of the several cultural heritage sites could be avoided.

Cultural Heritage	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-2	-2	-2	-2	-2	-1	-2	-2

8.3.3 Disruption due to Construction

Considers the extent of online construction and its disruption to strategic traffic. It also considers the number of minor road crossings, watercourse crossings and proximity to housing and sensitive locations. As all route options will cause some degree of disruption during the construction phase, all score negatively.

There would be delay and disruption to strategic traffic on the key transport corridor and to local traffic at tie-ins between the key transport corridor and local connector roads. There would be noise, vibration, traffic, visual and air quality impacts at housing and commercial businesses in the vicinity of the construction works. There would be a potential risk of accidental spillage affecting watercourses during construction. There may be sediment and bank habitat disturbance on watercourses. The south corridor would cause the least amount of disruption during construction, as the options are largely offline, with minimal crossings of the existing A6.

Disruption	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-1	-3	-3	-1	-1	-2	-1	-1

8.3.4 Ecology & Nature Conservation

This aspect considers the impact on designated ecological sites and non-designated sites of nature conservation interest. It also considered the number of watercourses, woodland areas and hedgerows traversed, along with the types of habitat affected.

Overall the area is considered to be of low ecological value and of only local importance. Loss of woodland habitat would be minimal. As with any road improvement scheme it is expected that a considerable amount of hedgerow will be lost. Further surveys will be required to establish the ecological significance of this. None of the route corridors would pass through designated ecological sites.

As all route options will cause some degree of disturbance to the local ecology and habitats, then they all score negatively.

Ecology	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-1	-1	-1	-2	-2	-1	-2	-2

8.3.5 Landscape & Visual

The assessment considers the affect on designated and non-designated areas of landscape value, along with key landmarks and features in the area. It also considers the impacts of the various route options on the landscape and the position that the route would occupy in the area. Route options could potentially score either positively or negatively, depending on their impact.

Option 3 would follow the existing alignment of the A6 for approximately 60 % of its length. With a proposed slight realignment at chainage 1800-2000 to avoid the creation of a cutting in the drumlin, this would be a very low impact option and from a landscape perspective, would be the preferred route. Option 2 would follow the existing alignment of the A6 for approximately 40 % of its length. Option 5 is located 10-40m north and south of the existing A6. Both options 2 and 5 would follow the landform and would also be suitable options. The south corridor route options would be the least favoured from a landscape perspective, as they would disrupt the undulating landform and introduce a main road to new area. The north corridor route options would increase the distance to and reduce the visibility of the strategic road from Lough Neagh.

Landscape	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-2	-2	-1	-2	-1	-2	-2	-2

8.3.6 Land Use

Land Use considers potential demolition of private property and associated landtake. It also considers potential loss of development land, the effect each route option would have on approved and pending planning applications, along with the loss and severance of agricultural land. As all route options will result in a loss of current land use, even if it is just low quality agricultural land, all score negatively.

The alignment with the least impact, in terms of potential demolition, is option 7 with only one residential property having to be demolished. Option 3 (online) would have the greatest impact with most properties being affected by the proposal. The south corridor would have the least overall potential demolition impact, with the central corridor having the greatest. All options would result in agricultural field severance, however option 3 (online) would result in the least new severance. The south corridor would affect the least number of planning applications. Route option 3 within the central route corridor would affect the most. All options would traverse an area of designated 'Green Belt', southwest of Randalstown. All options would traverse extensive areas of Best & Most Versatile agricultural land although the south corridor would traverse the least.

Land Use	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-2	-1	-3	-3	-2	-1	-1	-2

8.3.7 Traffic Noise & Vibration

This aspect considers the total number of properties that would be within 300 metres of both the existing route and proposed route options. It also considers the number of sensitive locations (schools, elderly person homes, community facilities etc.) and their proximity.

The south corridor would have the fewest number of properties within 100 metres of its route options. Both the north and south corridors would move the strategic traffic away from the noise sensitive location of Moneynick Primary School.

Traffic Noise	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	1	1	-1	1	-1	1	1	1

8.3.8 Pedestrians, Cyclists, Equestrians & Community Effects

This aspect considers the potential long-term implications on the community as a result of a change to the road network. To this end it assesses the number of minor roads, Public Rights of Way, and walking trails traversed. It also assesses the impact route options would have on equestrian facilities and trotting routes, as well as the impact on cycle paths and National Cycle Network (NCN) routes. In terms of actual community facilities, such as schools, libraries and shops for example, it considers the implications the route options would have on access to such places and the resultant amenity. Hence it assesses the degree of severance from such facilities that may be experienced. Where there would be a reduction in the degree of community severance, the route option scores positively.

No designated cycle routes would be affected by the proposed scheme. No specific equestrian facilities would be affected by the proposed scheme. There is little existing provision made for pedestrians, however with any of the offline options, amenity for pedestrians would be improved on the downgraded section of the Moneynick Road. The community may be encouraged to make more local vehicle movements than are currently made, due to a safer highway environment. New permanent diversions and access arrangements would be required to accommodate local vehicle movements, as access onto the high standard dual carriageway would be restricted.

Community Effects	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	1	-1	-3	2	1	-1	2	2

8.3.9 Vehicle Travellers

This section assesses two main aspects. Firstly, it considers views from the road that may be experienced by a vehicle traveller and secondly, it considers potential driver stress levels and how these will change from the existing route to those along the various route options. As a primary objective associated with any proposed road scheme is that it should improve road safety and the passage of traffic. Therefore all routes will score positively on this aspect.

North and south corridor route options would result in more open and interesting views to the traveller, with potential panoramic views of the surrounding countryside. Currently, driver stress levels along the A6 between Randalstown and Toome is considered to be 'high', and would be assessed as 'moderate' on completion of the proposed new dual carriageway. Any of the proposed route options would improve road safety with a potential reduction in strategic/local vehicle conflict.

Vehicle Travellers	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	2	2	1	2	2	2	2	2

8.3.10 Water Quality & Drainage

This section considers the number of watercourses traversed by the various route options and their significance. On this basis, an assessment is made on the number of designated watercourses (under the EC Freshwater Fish Directive) crossed, along with an assessment of their biological and chemical water quality, which gives an indication of their sensitivity. The number and extent of floodplains traversed is also assessed, as the route option may change the flooding characteristics of the river channel. Options which traverse watercourses score negatively, as there is potential for long term alteration to their characteristics.

Four minor watercourses would be traversed by the eight route options, albeit at slightly different locations. There are no recorded floodplains in the study area. There are no designated Salmonid or Cyprinid watercourses in the immediate study area, however the minor watercourses traversed are tributaries of such designated waterbodies and their protection from contamination is paramount. Although there are no major watercourses affected by the scheme, consideration must be given in the design of the new dual carriageway to ensure there is no deterioration in water quality of the minor streams and the wider river system or an increased risk of flooding in the surrounding area.

Water Quality	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-1	-1	-1	-1	-1	-1	-1	-1

8.3.11 Geology & Soils

This section considers the solid and drift geology and soil types of the area affected by the various route options. More importantly however, it assesses the impact on Geologically Important Sites (GIS), potentially contaminated land, areas of mineral extraction, and the groundwater vulnerability. With respect to soil characteristics, an assessment is made on the potential loss of Best & Most Versatile (BMV) agricultural land and areas potentially infested with Potato Cyst Nematode (PCN) or Potato Wart Disease (PWD).

Glacial till and alluvial deposits mask the bedrock, especially along the surrounding rivers. Near Randalstown, bedrock is at or close to the surface. The dominant soil types of the area include surface water gleys, interspersed with shallow brown earths, peat and alluvium. These all have their own individual drainage and nutrient characteristics. There will be loss of some Best & Most Versatile (BMV) agricultural land within the landtake for any of the proposed route options, but slightly less within the south corridor. There are a limited number of potentially contaminated sites between Randalstown and Toome, most of which are classified as having a 'low' risk of contamination. The main potentially contaminated sites of concern are the two filling stations, which are traversed or in close proximity to several route options. The south route corridor would affect the least number of potentially contaminated sites. There are no licensed areas of mineral extraction within the immediate study area.

As all route options will cause some degree of disturbance to soil characteristics and loss of BMV land, all score negatively.

Geology & Soils	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	-1	-1	-1	-1	-1	-1	-1	-1

8.3.12 Policies & Plans

This section reviews all planning policies and guidance, which are likely to have a bearing on the proposed improvement scheme. The documentation includes strategic national framework strategies, through to the more detailed local plans.

At a national level the government seeks to strengthen economic and social cohesion by enhancing linkages through its policies within the Regional Development Strategy 2025 and the Regional Transportation Strategy for Northern Ireland 2002 – 2012. The Strategy identifies that a new dual carriageway between Randalstown and Toome will be amongst the initiatives to improve the Regional Strategic Transport Network (RSTN), offering significant economic benefits resulting from journey time reduction. At a more local level, it will be necessary to take cultural and natural heritage issues into consideration, but there is no other strong planning policy or land use zoning that is likely to affect the dualling proposal. Most policies at the strategic level recognise that road transport will remain the predominant means of transport for the foreseeable future but seek to utilise alternative forms of transport.

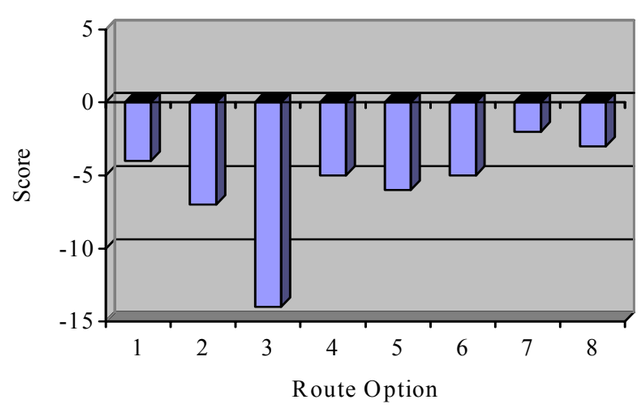
Where a route option is likely to be in adherence with planning policy and avoid other formally designated land uses, and then it will score positively.

Policies & Plans	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Score	1	1	1	1	1	1	1	1

8.3.13 Overall Environmental Scores

Each of the scores from the twelve individual engineering criteria were added together to derive the total ennvironmental scores for each route option. This aggregated score gives and overall assessment of the impact the construction of each route option would have. The results of the environmental scheme assessment are listed below in tabular and chart form.

Randalstown	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Air Quality	1	1	0	1	1	1	2	2
Cultural Heritage	-2	-2	-2	-2	-2	-1	-2	-2
Disruption	-1	-3	-3	-1	-1	-2	-1	-1
Ecology	-1	-1	-1	-2	-2	-1	-2	-2
Landscape	-2	-2	-1	-2	-1	-2	-2	-2
Land Use	-2	-1	-3	-3	-2	-1	-1	-2
Traffic Noise	1	1	-1	1	-1	1	1	1
Community Effects	1	-1	-3	2	1	-1	2	2
Vehicle Travellers	2	2	1	2	2	2	2	2
Water Quality	-1	-1	-1	-1	-1	-1	-1	-1
Geology & Soils	-1	-1	-1	-1	-1	-1	-1	-1
Policies & Plans	1	1	1	1	1	1	1	1
Total	-4	-7	-14	-5	-6	-5	-2	-3



8.4 Traffic and Economic Route Appraisal

This section relates to the preliminary comparative traffic and economic assessment of the eight route options being considered. The objective of the preliminary comparative assessment was to assess each of the options against the scheme cost, Net Present Value (NPV), Benefit to Cost Ratio (BCR), number of accident savings over 30 years and journey time savings in minutes, relative to the do-nothing scenario. All of the preliminary comparative assessments are based on low growth only.

8.4.1 Scheme Cost

The scheme costs for the options assessed were based on preliminary cost estimates of land and property, construction costs including 15% preliminaries and 10% contingencies, and preparation and supervision costs which are 9% and 5% respectively. An adjustment for risk allowance and optimism bias, as required by the new guidelines for the Appraisal and Evaluation in Central Government was also included which, at this stage of the scheme assessment, was taken as 44%.

8.4.2 Net Present Value

Net Present Value is calculated by subtracting the Present Value of Costs from the Present Value of Benefits. The NPV score shown in the comparative assessment is based on the average value in 1998 prices discounted to 1998 at a 3.5% discount rate for the 30-year evaluation period, reducing to 3.0% thereafter. It should be noted that option 1, has the highest NPV while the other options are broadly similar.

8.4.3 Benefit to Cost Ratio

The Benefit to Cost Ratios for the eight route options are broadly similar in value with none of the schemes being highlighted as providing better value for money than the other competing schemes.

8.4.4 Number of Accident Savings

The comparative assessment is based on the Number of Accident Savings calculated for the 30 year assessment period.

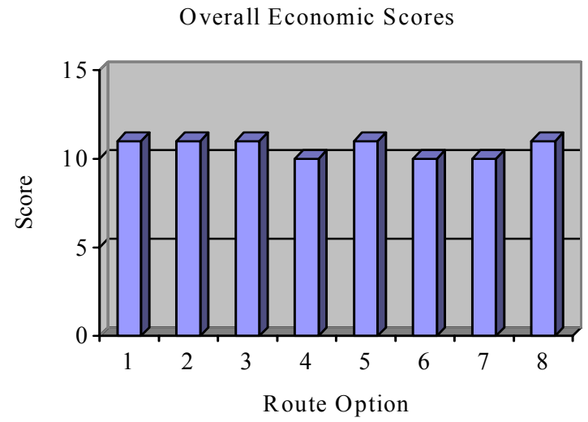
8.4.5 Journey Time Savings

The comparative assessment is based on the Savings in Journey Times between journey times on the existing road network and journey times on the improved road network.

8.4.6 Overall Economic Scores

Each of the scores from the four individual economic criteria were added together to derive the total economic scores for each route option. This aggregated score gives and overall assessment of the impact the construction of each route option would have. The results of the economic scheme assessment are listed below in tabular and chart form.

Randalstown	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7	Opt 8
Net Present Value	3	3	3	2	3	2	2	3
Benefit Cost Ratio	3	3	3	3	3	3	3	3
No. Accident Savings	3	3	3	3	3	3	3	3
Journey Times	2	2	2	2	2	2	2	2
Total	11	11	11	10	11	10	10	11



8.5 Comparison Models

8.5.1 Assessments

Sections 8.2, 8.3 and 8.4 of this report show the individual comparative route appraisals for the Engineering, Economic and Environmental criteria respectively. By adding these individual marks, an overall assessment of the effects of each route option can be made and are shown in tabular and graphical form below.

Engineering Assessment	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Geometry	1	1	1	2	1	3	3	3
Drainage	-1	-1	0	-1	-1	-2	-2	-2
Structures	-2	-2	-1	-2	-2	-1	-1	-1
Constructability	-1	-1	-2	0	-1	-1	0	0
Services	-1	-1	-2	-1	-1	-1	-1	-1
Earthworks/Geotechnical	-1	-1	-1	-2	-1	-2	-2	-1
Construction Cost	-2	-1	-1	-2	-2	-1	-2	-2
Property Take	-2	-1	-3	-2	-2	-1	-1	-1
Engineering Marks	-9	-7	-9	-8	-9	-6	-6	-5

Economic Assessment	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Net Present Value	3	3	3	2	3	2	2	3
Benefit Cost Ratio	3	3	3	3	3	3	3	3
No. Accident Savings	3	3	3	3	3	3	3	3
Journey Times	2	2	2	2	2	2	2	2
Economic Marks	11	11	11	10	11	10	10	11

Environmental Assessment	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Air	1	1	0	1	1	1	2	2
Cultural Heritage	-2	-2	-2	-2	-2	-1	-2	-2
Disruption Due To Construction	-1	-3	-3	-1	-1	-2	-1	-1
Ecology and Nature Conservation	-1	-1	-1	-2	-2	-1	-2	-2
Landscape and Visual Impacts	-2	-2	-1	-2	-1	-2	-2	-2
Land Use	-2	-1	-3	-3	-2	-1	-1	-2
Traffic Noise and Vibration	1	1	-1	1	-1	1	1	1
Pedestrian, Equestrian, Community Effects	1	-1	-3	2	1	-1	2	2
Vehicle Travellers	2	2	1	2	2	2	2	2
Water Quality and Drainage	-1	-1	-1	-1	-1	-1	-1	-1
Geology and Soils	-1	-1	-1	-1	-1	-1	-1	-1
Policies and Plans	1	1	1	1	1	1	1	1
Environmental Marks	-4	-7	-14	-5	-6	-5	-2	-3

8.5.2 Weighting

The marking methodology used in the above Engineering, Economic and Environmental assessments gives equal importance to each criteria. The engineering assessment includes items such as drainage and services that, although important enough to be merit detailed consideration, are less likely to influence the selection of a particular route than either construction cost or property take would. Similarly, the environmental assessment includes criteria that could be easily mitigated against during the design stage and should not merit the same importance as criteria such as visual impact or cultural heritage.

To address this issue, a weighting of between 1 and 3 was applied to each of the individual criteria depending on its significance, with 3 being assigned to those of the highest importance reducing to 1 for the least influence. The weighting factors used for each of the assessment criteria are shown in the table below:

Criteria	Weighting
Engineering:	
Geometry	3
Drainage	1
Structures	2
Constructability	2
Services	1
Earthworks	2
Construction Cost	3
Property Take	3
Economic:	
Net Present Value	3
Benefit Cost Ratio	3
No. Accident savings	3
Journey times	3
Environmental:	
Air	2
Cultural Heritage	3
Disruption Due to Construction	2
Ecology and Nature Conservation	3
Landscape and Visual Impacts	3
Land Use	2
Traffic Noise and Vibration	2
Pedestrian, Equestrian, Community Effects	2
Vehicle Travellers	2
Water Quality and Drainage	2
Geology and Soils	1
Policies and Plans	2

Applying the above weightings to the individual totals from the Engineering, Economic and Environmental assessments, gave a weighted mark for each of the 24 criteria reflecting their importance in the selection process.

Engineering Criteria	***weighting***	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Geometry	*3*	1	1	1	2	1	3	3	3
Drainage	*1*	-1	-1	0	-1	-1	-2	-2	-2
Structures	*2*	-2	-2	-1	-2	-2	-1	-1	-1
Constructability	*2*	-1	-1	-2	0	-1	-1	0	0
Services	*1*	-1	-1	-2	-1	-1	-1	-1	-1
Earthworks/Geotech	*2*	-1	-1	-1	-2	-1	-2	-2	-1
Construction Cost	*3*	-2	-1	-1	-2	-2	-1	-2	-2
Property Take	*3*	-2	-1	-3	-2	-2	-1	-1	-1
Engineering Marks		**-19**	**-13**	**-19**	**-16**	**-19**	**-8**	**-9**	**-7**

Economic Criteria	***weighting***	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Net Present Value	*3*	3	3	3	2	3	2	2	3
Benefit Cost Ratio	*3*	3	3	3	3	3	3	3	3
No. accident savings	*3*	3	3	3	3	3	3	3	3
Journey times	*3*	2	2	2	2	2	2	2	2
Economic Marks		**8**	**8**	**8**	**3**	**8**	**3**	**3**	**8**

Environmental Criteria	***weighting***	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Air	*2*	1	1	0	1	1	1	2	2
Cultural Heritage	*3*	-2	-2	-2	-2	-2	-1	-2	-2
Disruption due to Construction	*2*	-1	-3	-3	-1	-1	-2	-1	-1
Ecology and Nature Conservation	*3*	-1	-1	-1	-2	-2	-1	-2	-2
Landscape and Visual impacts	*3*	-2	-2	-1	-2	-1	-2	-2	-2
Land Use	*2*	-2	-1	-3	-3	-2	-1	-1	-2
Traffic Noise and Vibration	*2*	1	1	-1	1	-1	1	1	1
Pedestrian, Equestrian, Community Effects	*2*	1	-1	-3	2	1	-1	2	2
Vehicle Travellers	*2*	2	2	1	2	2	2	2	2
Water Quality and Drainage	*2*	-1	-1	-1	-1	-1	-1	-1	-1
Geology and Soils	*1*	-1	-1	-1	-1	-1	-1	-1	-1
Policies and Plans	*2*	1	1	1	1	1	1	1	1
Environmental Marks		**6**	**2**	**1**	**4**	**3**	**5**	**8**	**7**

8.5.3 Ranking & Scoring

To select a preferred corridor, an overall score for each route option had to be determined from the 3 assessments. As the engineering, economic and environmental assessments were based on 8, 4 and 12 criteria respectively, simply, adding the total marks would place more emphasis on the environmental mark.

Each Route Option was therefore ranked between 1 and 8, based on their performance in each of the three assessments. Those performing best in the individual assessments were ranked first and the worst ranked last. This provided a league table of the Route Options based on their mark in each assessment.

A score from 1 to 8 was subsequently assigned to each Route Option, based on their Ranking, with the highest score given to the highest-ranking Option. The Ranking and Scores assigned to each Route Option are shown in the table below:

	Opt 1	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Engineering Assessment								
Weighted Marks	-19	-13	-19	-16	-19	-8	-9	-7
Rankings	*6th=*	*4th*	*6th=*	*5th*	*6th=*	*2nd*	*3rd*	*1st*
Scores	3	5	3	4	3	7	6	8
Economic Assessment								
Weighted Marks	8	8	8	3	8	3	3	8
Rankings	*1st=*	*1st=*	*1st=*	*6th=*	*1st=*	*6th=*	*6th=*	*1st=*
Scores	8	8	8	3	8	3	3	8
Environmental Assessment								
Weighted Marks	6	2	1	4	3	5	8	7
Rankings	*3rd*	*7th*	*8th*	*5th*	*6th*	*4th*	*1st*	*2nd*
Scores	6	2	1	4	3	5	8	7

Finally, for each option, the engineering, economic and environmental scores were totalled to give a combined score. This determined the best performing option overall, shown in table below.

Weighted Model	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Engineering Score	3	5	3	4	3	7	6	8
Economic Score	8	8	8	3	8	3	3	8
Environmental Score	6	2	1	4	3	5	8	7
Overall Scores	**17**	**15**	**12**	**11**	**14**	**15**	**17**	**23**

8.5.4 Scheme Assessment – Route Options

The scores detailed above were developed as part of a Weighted comparison model, as the overall scores were determined by allocating weightings to each assessment criteria according to their significance.

In addition to the Weighted comparison model, a further three comparison models were developed. An Engineering and Economic Bias model considers only the engineering and economic criteria, with their allocated weightings, but with each of the environmental criteria given a weighting of zero, effectively switched off. Similarly, an Environmental Bias model considers only the environmental criteria and the engineering and economic switched off. An Unweighted model derived overall scores by placing equal importance on all the assessment criteria, i.e. all weighting set to a value of 1.

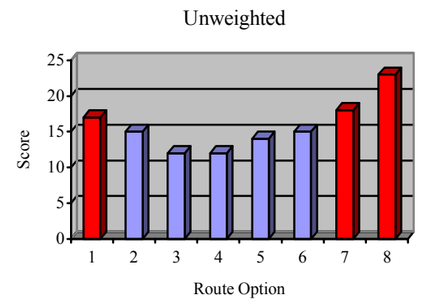
The overall scores were totalled as detailed above for the weighted model. Results for each of the four comparison models are listed in the tables below. Results for the four comparison models are also show in chart form, with the top three options highlighted.

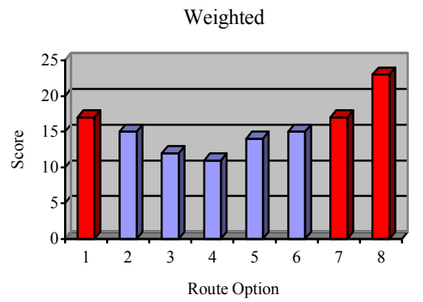
Unweighted Comparison Model	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Engineering Score	3	5	3	4	3	7	6	8
Economic Score	8	8	8	3	8	3	3	8
Environmental Score	6	2	1	4	3	5	8	7
Overall Scores	**17**	**15**	**12**	**12**	**14**	**15**	**18**	**23**

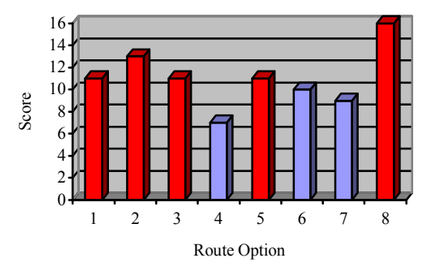
Weighted Comparison Model	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Engineering Score	3	5	3	4	3	7	6	8
Economic Score	8	8	8	3	8	3	3	8
Environmental Score	6	2	1	4	3	5	8	7
Overall Scores	**17**	**15**	**12**	**11**	**14**	**15**	**17**	**23**

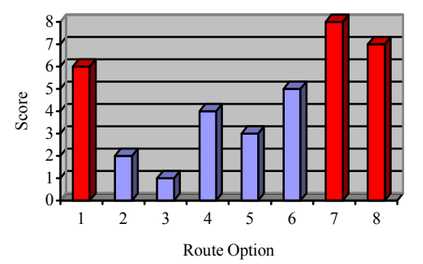
Engineering/Economic Comparison Model	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Engineering Score	3	5	3	4	3	7	6	8
Economic Score	8	8	8	3	8	3	3	8
Environmental Score	0	0	0	0	0	0	0	0
Overall Scores	**11**	**13**	**11**	**7**	**11**	**10**	**9**	**16**

Environmental Comparison Model	**Opt 1**	**Opt 2**	**Opt 3**	**Opt 4**	**Opt 5**	**Opt 6**	**Opt 7**	**Opt 8**
Engineering Score	0	0	0	0	0	0	0	0
Economic Score	0	0	0	0	0	0	0	0
Environmental Score	6	2	1	4	3	5	8	7
Overall Scores	**6**	**2**	**1**	**4**	**3**	**5**	**8**	**7**









8.5.5 Scheme Assessment – Corridors

In order to establish whether any one corridor performed better than the others, the three route corridors were also assessed. Overall scores for the route corridors were determined simply by averaging the overall score for the route options within each corridor. Therefore, the scores for options 1 and 2 were averaged to determine the north corridor score, the scores for option 3, 4 and 5 were averaged to give the central corridor score, and the scores for options 6, 7 and 8 were averaged to give the south corridor score. The results are detailed below in both tabular and chart form, with the preferred top corridor highlighted in each case.

	North	Central	South
Un-weighted Model	16.0	12.7	18.7
Weighted Model	16.0	12.3	18.3
Engineering/Economic Model	12.0	9.7	11.7
Environmental Model	4.0	2.7	6.7