KPMG

CORPORATE FINANCE

TRANSLINK

Economic Appraisal of the Coleraine to Derry Track Renewals Project

DRAFT
June 2010

ADVISORY

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Contents

Glossary

Abbreviation	Meaning
AWS	Automatic Warning System
BAH	Booz Allen Hamilton
BNCR	Belfast and Northern Counties Railway Company
CAA	Civil Aviation Authority
DCCA	Derry City Council Area
DDA	Disability Discrimination Act
DMUs	Diesel Multiple Units
GSMR	Global Systems Mobile Communication for Railway
HMRI	Her Majesty's Railway Inspectorate
MSLs	Level crossing with Miniature Stop Lights
NIR	Northern Ireland Railways
NITB	Northern Ireland Tourist Board
NITHC	Northern Ireland Transport Holding Company
NTT	New Trains Two
PSRs	Permanent Speed Restrictions
REB	Relocateable Equipment Building
RRG	Railway Review Group
RSTNP	Regional Strategic Transport Network Plan
RSTNT	Regional Strategic Transport Network Transport Plan
RTS	Regional Transportation Strategy
TPWS	Train Protection and Warning System
TSRs	Temporary Speed Restrictions
UTA	Ulster Transport Authority
UWCs	User Worked Crossings

I Executive Summary

I.1 Terms of reference

KPMG has been commissioned by Translink to undertake an Economic Appraisal of the Coleraine to Derry Track Renewals Project.

The economic appraisal has been prepared based on the following primary sources of guidance:

- "The Green Book: Appraisal and Evaluation in Central Government", HM Treasury 2003[1]; and
- The Northern Ireland Guide to Expenditure Appraisal and Evaluation (*NIGEAE*), 2009[2].

I.2 The Coleraine to Derry Track Renewals Project

The Coleraine to Derry permanent way is typically a minimum of 32 years in service. The signalling system is older still and is largely a token-block system. The permanent way has deteriorated over time requiring changes to the operational speed on the line for safety reasons. The head of permanent way has reduced the line speed from 70mph to 60mph, supplemented with additional lower temporary speed restrictions. These measures have been implemented in recognition of the asset condition. Failure to carry out significant repairs now will lead to further reductions in line speed. The infrastructure could not offer the necessary performance required to provide the services envisaged by the New Trains Two (NTT) Project.

The Coleraine to Derry Track Renewals Project has therefore been initiated so that the objectives of the NTT project could be met. During the Project Initiation stage the following objectives were identified as key outputs from the proposed renewal project. The following outlines the project in terms of anticipated outcomes:

- Renew track infrastructure to ensure minimum 30 year operational life;
- Recover Permanent Speed Restrictions (PSRs) to 2001 levels;
- Remove Temporary Speed Restrictions (TSRs);
- Upgrade line speed where possible to maximum 90mph;
- Upgrade signalling to current standards;
- Relocate signal cabins at Derry, Castlerock and Portrush to Coleraine;
- Provide infrastructure capacity for hourly train frequency and facilitate future installation for a half hourly service, with a first arrival at Derry before 9am[3];
- Incorporate track and signalling layout to facilitate the development of any new station at Derry;

[1] See: www.hm-treasury.gov.uk/Economic_Data_and_Tools/Greenbook/data_greenbook_index.cfm
[2] See: www.dfpni.gov.uk/eag
[3] A 9am arrival is currently unavailable due to infrastructure constraints which is having adverse implications for commuter timetabling between Coleraine, Ballymoney, Ballymena and Belfast

- Review location of intermediate halts including Park and Ride;
- Ensure signalling compatibility with future GSMR (Global Systems Mobile Communication for Railway); and
- Complete essential signalling works along Portrush branch line.

I.3 Strategic Context

The Strategic Context section of the report considers the particular aims and objectives of key interest groups to ascertain the context within which the project fits. The following have been considered:

- Department for Regional Development (DRD):
  - Regional Development Strategy for Northern Ireland 2025;
  - Regional Transportation Strategy for Northern Ireland 2002-2012;
  - Regional Strategic Transport Network Transport Plan 2015;
  - Accessible Transport Strategy 2015;
- Translink:
  - Review of the Future of Railway in Northern Ireland – Report by the Railways Taskforce;
  - Translink Corporate Plan 2009/2010 – 2011/2012;
  - Translink Action Plan;
  - Translink Passenger Charter;
- Office of the First Minister and Deputy First Minister (OFMDFM):
  - Lifetime Opportunities;
  - Statutory Equality Obligations;
  - Sustainable Development Strategy for Northern Ireland;
- Safety Decision Making (Health and Safety Executive); and
- Ilex Regeneration Plan.

The strategic context concludes that the proposed project is in line with many strategies and policies as well as Translink's own vision. The proposed project fits with the strategies and policies outlined above in terms of:

- Modernising the transport infrastructure;
- Bringing the standard of the signalling elements into line with current required standards;
- Ensuring an expected asset life of 30 years;
- Meeting Translink's Sustainability Strategy; and

- Meeting Translink's Safety Strategy.

In terms of the Sustainability Strategy, Translink is committed to providing a sustainable solution for each new project. A sustainable solution is a careful balance between environmental impact, social considerations, capital cost and whole life costs.

I.4 Identification of Need

The Need section of the appraisal considers in detail the 'need' for the Coleraine to Derry Track Renewals Project. In making this assessment the current infrastructure, current and future demand and the objectives of the NTT project are considered in order to assess the demand for train services on this line and therefore the need for implementing the proposed project.

The need for this project has been determined in terms of the following:

- The current Coleraine to Derry Track Infrastructure;
- Booz Allen Hamilton (February 2007)[4]: Assessment of Current and Future Demand;
- Objectives Stipulated within the NTT project and the Booz Allen Hamilton Report (November 2008)[5]: Future Timetable Requirements; and
- NIR's future design timetable for the Belfast to Derry route for operation post the NTT Programme.

The Need discusses the findings detailed within the Booz Allen Hamilton reports and the feasibility study carried out by Arup in August 2009. These have indicated that there has been historical passenger growth and there is the potential for future passenger growth. The findings emphasise the need for continuation of the service and, in order to continue to provide this service, there is a need to ensure that the infrastructure is of an appropriate standard to maintain its asset capacity for the foreseeable future.

Under the NTT project there is an objective to increase the frequency of services in the future. In order to meet the timetable requirements there is a need for track modifications so the line can cope with the proposed additional traffic and hence meet the new timetable. The proposed project aims to implement an appropriate level of changes so that the timetable objectives can be met in the future.

Overall, it is clear that as a result of implementation of the NTT project and the objectives associated with it, there is a need to implement modifications to the track structure of the Coleraine to Derry section of the line in an attempt to create potential for the objectives of the NTT project to be met.

With regards to health and safety there is a need to ensure that the track is maintained at such a level that both passengers and staff of Translink are safe and requirements are met. If the track does not receive any major capital investment works and is continued to be maintained on an upkeep basis the track will suffer irreparable damage and will not comply with the health and safety legislation. The repercussions of this could be great in financial and non-financial terms.

[4] Booz Allen Hamilton Report: Business Development Analysis for Northern Ireland Railways (February 2007)
[5] Booz Allen Hamilton Report: Derry to Belfast Infrastructure Capacity Study (November 2008)

Finally, there is a need to ensure that any works carried out allow for the halt at Bellarena to continue to operate as this is necessary in order to provide a rail link for Limavady.

I.5 Objectives and Constraints

The key project objectives have been outlined by Translink and are as follows:

- To provide the necessary infrastructure to facilitate the 2012/2013 timetable identified under the NTT project and the Coleraine to Derry Track Renewals Project Initiation Document; and
- To meet the aspirations of the Minister for Regional Development for the rail service to Northern Ireland's second city, with an arrival from Belfast before 9am.

These objectives have been set in place in an attempt to ensure that the two key objectives outlined above are met. They are as follows:

- Renew the existing permanent way to current design standards to ensure a minimum 30 year design life;
- Deliver the necessary line speed enhancements to facilitate the requirements of the proposed 2012/2013 timetable by:
  - Recovering PSRs to 2001 levels;
  - Removing TSRs; and
  - Upgrading line speed where possible to a maximum of 90mph.
- Provide the correct passing loop infrastructure to facilitate the requirements of the proposed 2012/2013 timetable;
- Deliver health and safety improvements for the whole line; and
- Renew signalling to current standards.

I.6 Identification of Options

The Identification of Options section commences by detailing the long list of options identified by Translink for the implementation of the Coleraine to Derry Track Renewals project. It then discusses the merits and downsides of each of the options and concludes by setting out the options short-listed for in-depth appraisal.

Each identified option has been assessed in the context of whether its anticipated effect will satisfy the principal objectives or violate important constraints, and the extent to which same will satisfy the screening criteria, to determine which options will be short-listed for in depth appraisal.

Option One, i.e. "do nothing" to the current infrastructure of the Coleraine to Derry line. This option involves Translink continuing with the current maintenance regime and the current overall PSR remaining in force. However, it is not envisaged that the current infrastructure of the line would have a lengthy remaining useful life.

Without some level of heavy maintenance the permanent way would continue to deteriorate and would not be able to continue with normal operations as the Permanent Way Engineer will be required to, not only enforce current PSR, but also introduce increasingly more stringent speed restrictions, either at discrete locations or over larger stretches of the line. As a result, the line speed would fall and therefore the journey time would increase until a journey by rail would no longer be viable for passengers.

As a result, passengers would seek alternative modes of transport. The passenger movement away from the rail service between Coleraine and Derry would negatively impact against the overall provision of the service and eventually, after only a few years, result in the closure of the line. Closing this section of the track does not meet with the key objectives outlined within Translink's objectives or within the NTT project.

The following Options are taken forward to full appraisal:

Option	Description
Option 2a	Do Minimum: Heavy Maintenance
Option 3a	Full Renewal with One Loop Only (Baseline)
Option 3b	Full Renewal with One Loop Only (without the Bridge Works)
Option 4a	Full Renewal with Two Loops including a DDA compliant halt at Bellarena
Option 4b	Full Renewal with Two Loops including a DDA compliant halt at Bellarena (without the Bridge Works)

I.7 Monetary Costs and Benefits

The Monetary Costs and Benefits section presents an evaluation of the short-listed options in economic terms. Summary capital expenditure under each option is set out below along with details of any monetary benefits delivered. In addition, project management costs estimated by Translink and Arup have been included. For the purpose of this appraisal VAT has been excluded from the economic analysis.

The table below shows a summary of the capital costs identified for each option. Note that the capital costs below ***exclude*** optimism bias.

Option	Sunk Costs (£)	Initial Capital Outlay (excl Sunk Costs) (£)	Annual Revenue Cost Post Implementation (Post yr 12) (£)	Signalling and Maintenance Costs (£)	Additional Capital Required in Year 5/12 (£)
2a	725,021	47,307,131	776,468 (473,267)	115,810	37,917,180
3a	725,021	62,412,342	473,267	-	-
3b	725,021	60,040,983	473,267	-	4,370,984
4a4a	725,021	66,781,650	473,267	-	-
4b	725,021	64,410,293	473,267	-	4,370,984

The table below highlights the economic dis-benefit for Option Two.

Category	Economic Dis-benefit (£)
Time Savings	(328,134)
Vehicle Operating Costs	(13,621)
Total Benefit/(Cost)	**(341,755)**

I.8 Optimism Bias, Risk and Uncertainty

The following table details the contributory factors and the mitigation factors considered for the calculation of Optimism Bias for Option 2a.

Contributory factor	%	Mitigation factor	Result (%)
Late contractor involvement in design	3	0.2	0.6
Dispute and claims occurred	21	0.4	8.4
Environmental Impact	22	0.1	2.2
Other	18	0.5	9.0
Inadequacy of the business case	10	0.5	5.0
Poor project intelligence	7	0.5	3.5
Public relations	9	0.1	0.9
Site characteristics	3	0.1	0.3
Economic	7	0.1	0.7
Total	**100**	**-**	**30.6**

Resultant capital expenditure optimism bias =

(100% - 30.6%) x 44% = 30.5%.

The following table details the contributory factors and the mitigation factors considered for the calculation of Optimism Bias for Options 3(a & b) and 4(a & b).

Contributory factor	%	Mitigation factor	Result (%)
Late contractor involvement in design	3	0.4	1.2
Dispute and claims occurred	21	0.4	8.4
Environmental Impact	22	0.4	8.8
Other	18	0.8	14.4
Inadequacy of the business case	10	0.7	7.0
Poor project intelligence	7	0.7	4.9
Public relations	9	0.6	5.4
Site characteristics	3	0.4	1.2
Economic	7	0.4	2.8
Total	**100**	**-**	**54.1**

Resultant capital expenditure optimism bias =

(100% - 54.1%) x 44% = 20.2%.

The following table illustrates the total cost for each option, taking into account the capital cost and optimism bias:

Category	Option 2a	Option 3a	Option 3b	Option 4a	Option 4b
Expenditure (excluding sunk costs)	85,224,306	62,412,342	64,411,966	66,781,650	68,781,276
Optimism Bias (30.5% / 20.2%)	25,993,413	12,607,293	13,011,217	13,489,893	13,893,818
Capital Adjusted Cost (£)	**111,217,719**	**75,019,635**	**77,423,183**	**80,271,543**	**82,675,093**

I.9 Non-monetary Costs and Benefits

It is often difficult to apply a monetary value to some of the costs and benefits associated with each of the options. These non-monetary costs and benefits should not be discounted as being any less important than the monetary values, indeed in many cases they are crucial in the decision making process. Therefore a suitable method of evaluating these non-monetary factors must be applied. For the purpose of this appraisal the weighted scoring approach is applied. This section begins by discussing the weighted scoring methodology and then proceeds to discuss the rationale underlying the scores awarded to each of the short-listed options.

The benefit criteria are as follows:

- ***Criterion One:*** Ability to meet NTT and Translink objectives with regards to the future 2012/2013 timetable requirements;
- ***Criterion Two:*** Ability to allow, an arrival in Derry from Belfast before 9am;
- ***Criterion Three:*** Ability to improve the health and safety aspects of the track and upgrade for DDA compliance;
- ***Criterion Four:*** Ability to ensure that the current infrastructure is upgraded to ensure a lifespan of 30 years (minimum);
- ***Criterion Five:*** Ability to ensure the signalling is upgraded to current required safety standards; and
- ***Criterion Six:*** Carry out other major works that require a possession or blockade (this will ensure that no works requiring possession will be required for five years from the date of reopening following renewal).

The Guidance on Methods for Multi-Modal Studies recommends that options are scored against non monetary criteria considering:

- ***Safety:*** dealt with under Criteria Three and Five above;
- ***Accessibility:*** dealt with under Criteria One, Two and Three above;
- ***Integration:*** dealt with under Criteria One and Two above;
- ***Environment***[6]***:*** dealt with under Criteria Three and Five above; and

[6] This relates to the reduction of accidents and to improve safety in respect of this GOMMMS

- ***Wider economic benefits:*** dealt with under Criteria One, Two,Four and Six above.

Each benefit criterion was weighted to give a total score of 100 for all five criteria with the most important receiving the greatest weighting. Each of the short listed options was then scored out of 10 against each benefit criterion and this score multiplied by the allocated weighting to produce a "weighted score." The total weighted score for each option was compared to give a qualitative ranking.

In summary, the weighting for each benefit criterion may be detailed as follows:

Benefit criteria		Weighting
Criteria 1	Ability to meet NTT and Translink objective with regards to the future 2012/2013 timetable requirements	20
Criteria 2	Ability to allow an arrival in Derry from Belfast before 9am	20
Criteria 3	Ability to improve the health and safety aspects of the track and upgrade for DDA compliance	20
Criteria 4	Ability to ensure that the current infrastructure is upgraded to ensure a lifespan of 30 years (minimum)	10
Criteria 5	Ability to ensure the signalling is upgraded to current required standards	10
Criteria 6	Carry out other major works that require a possession or blockade	20
Total		**100**

The following table summarises each option's score against the non-monetary criteria. The options are then ranked in the order in which they most satisfy the non-monetary criteria.

Criteria	Weighting	2a		3a		3b		4a		4b	
		Score	WS	Score	WS	Score	WS	Score	WS	Score	WS
1	20	0	0	10	200	8	160	10	200	8	160
2	20	0	0	10	200	8	160	10	200	8	160
3	20	6	120	9	180	7	140	10	200	7	140
4	10	4	40	10	100	10	100	10	100	10	100
5	10	6	60	10	100	10	100	10	100	10	100
6	20	0	0	10	200	0	0	10	200	0	0
Total	**100**	**-**	**220**	**-**	**980**		**660**	**-**	**1000**		**660**
Rank		**5**		**2**		**3**		**1**		**3**	

Option 2a scores 220 overall under non-monetary assessment as it does not meet all of the project objectives and hence, contributes less towards the non-monetary criteria than the other Options.

From a qualitative viewpoint Option 3a ranks second and Option 4a ranks first.

I.10 Quantitative Analysis

Quantitative analysis assesses the performance of each option on a quantitative basis. The quantitative analysis was completed using a net present cost (NPC) calculation. A detailed profiling of the expenditure across the project time-span was provided by Translink and used in this calculation.

Set out below is a summary of the net present costs for each option:

Option	Capital Cost (Incl OB) (£)	Annual Revenue Cost Post Implementation (Post yr 12) (£)	Signalling and Maintenance Costs (£)	Additional Capital Required in Year 5/12 (£)	Dis-benefits (£)	NPC (£)
2a	61,735,800	776,468 (473,267)	115,810	49,481,920	341,755	**101,226,083**
3a	75,019,632	473,267	-	-	-	**79,213,483**
3b	72,169,260	473,267	-	5,253,923	-	**80,959,171**
4a	80,271,542	473,267	-	-	-	**84,147,743**
4b	77,292,352	473,267	-	5,245,181	-	**85,893,433**

The results of the NPC analysis indicate that Option 3a would represent the best option in terms of cost with an NPC of **£79,213,483**.

I.11 Selection of Preferred Option, Summary and Conclusions

The table below illustrates the monetary and non monetary assessment of each of the options under appraisal.

Option	OB Adjusted Capital Cost (£) (including sunk costs)	Net Present Cost (£)	Quantitative Ranking	NMS	Qualitative Ranking
2a	111,217,720	**101,226,083**	5	220	5
3a	75,019,632	**79,213,483**	1	980	2
3b	77,423,183	**80,959,171**	2	660	4
4a	80,271,542	**84,147,743**	3	1,000	1
4b	82,675,094	**85,893,433**	4	660	3

Option 2a has the highest NPC and the lowest Non-monetary score. It should also be noted that in section 6.10 this option had economic dis-benefits associated with it amounting to £341,755.

Option 4a has the highest non monetary score of 1,000, marginally ahead of Option 3a which has a non monetary score of 980. Option 3a has the lowest monetary cost and is almost £5 million less costly in NPC terms than Option 4a.The marginal non monetary advantage of Option 4a over Option 3a does not justify the additional monetary cost of Option 4a. Option 3a is also less costly than Options 3b and 4b but delivers greater non monetary benefit.

On this basis, it is recommended that Option 3a is the Preferred Option which offers Value for Money and which has the potential to meet the overall project objectives for a lesser cost than Option 4a or 4b.

1 Introduction

1.1 Terms of reference

KPMG has been commissioned by Translink to undertake an Economic Appraisal of the Coleraine to Derry Track Renewals Project.

The economic appraisal has been prepared based on the following primary sources of guidance:

- "The Green Book: Appraisal and Evaluation in Central Government", HM Treasury 2003[7]; and
- The Northern Ireland Guide to Expenditure Appraisal and Evaluation (*NIGEAE*), 2009[8].

1.2 Background to the Northern Ireland Transport Holding Company

Northern Ireland Transport Holding Company (NITHC) was established by the Transport Act (NI) 1967 as a body corporate with perpetual succession. The public transport bus and rail services are presently provided by wholly owned subsidiaries of NITHC, namely Ulsterbus, Citybus and Northern Ireland Railways.

The integration of these services began in 1995 when the Government announced comprehensive changes to the provision of public transport in an attempt to promote the transfer from private car to public transport on a sustainable basis, bus and rail services (Metro/Northern Ireland Railways/Ulsterbus) were integrated under one organisation which was named Translink. Translink is the brand name and the three operating services have retained their legal status.

Translink is dedicated to improving the integration and efficiency of the transport system in Northern Ireland and is now believed to be one of the largest groups in Northern Ireland with approximately 4,200 employees and a turnover in excess of £180m. Over 80 million passenger journeys were made on Translink services in 2008/2009[9].

Translink has developed a vision statement and believes that the values and guiding principles contained within are fundamental to its success, each of which are detailed below. Its vision is:

"We will provide integrated travel solutions that are attractive, sustainable and good value".[1]

[7] See: www.hm-treasury.gov.uk/Economic_Data_and_Tools/Greenbook/data_greenbook_index.cfm
[8] See: www.dfpni.gov.uk/eag
[9] Source: www.translink.co.uk

Translink has a number of Values, which are as follows:

Safety: Safety is paramount. High standards maintained for customers, employees and the general public.
People: Our people make the difference in the service our customers receive. We want to provide an environment to attract, retain and motivate the best.
Community: Our services enrich the economy, the environment and the life of communities in a sustainable fashion. We want to be a good neighbour.
Governance: Not only is this about control and accountability but identifying and achieving objectives.

Translink is responsible for the maintenance and upkeep of the present railway system in Northern Ireland which comprises approximately 190 route miles/304 kilometres including the Belfast-Dublin main line, a line to Coleraine and Derry, with a branch line from Coleraine to Portrush, and suburban routes from Belfast to Portadown, Bangor, and Larne.

Translink strives to continuously maintain and improve the railway infrastructure within Northern Ireland and has seen a significant increase in rail passenger numbers from 6.6 million in 2002/2003 to 10.2million in 2008/2009. Both these figures include enterprise passengers (Translink Corporate Plan 2009/2010 – 2011/2012).

Before and during 2006/2007 all aspects of the service provided were enhanced including the roll out of new stock, timetable development, passenger information, advertising, customer service delivery and station improvements. Specific improvements include the regular passenger service use of 23 new C3K state of the art trains, a new purpose built Train Care Centre ensuring trains are kept in optimum condition, the promotion of a new corporate culture with innovative customer care training programmes, completion of the relaying of track and upgrading of signalling equipment between Belfast (Bleach Green) and Whitehead and a new timetable with faster and more frequent services for customers. Future developments include plans to implement frequency improvements for Ballymena, Antrim and the Larne line further to the 'Strategic Railway Review' which concluded that the '*lesser used lines were economically viable as part of the total existing network'*.

Translink's ability to proceed with these developments has been enabled through funding in the period 2002-2012 under the Regional Transportation Strategy (RTS) for the Northern Ireland highway/roads network. Additionally the Regional Transportation Strategy envisages expenditure of £502.9 million over the ten years of the strategy in a bid to reduce the infrastructure deficit arising from years of under investment in Northern Ireland's public transport system.

1.3 Background of the Coleraine to Derry Track Renewals Project

1.3.1 Description of the Coleraine to Derry Line

The Coleraine and Derry Line is a predominantly single track line with a passing loop at Castlerock Station. There is one other intermediate stop at Bellarena, located north east of Limavady. The line is 33.5 miles long with infrastructure that dates to approximately 1978.

1.3.2 New Trains Two Project

Following the Railway Task Force Report in September 2000, the Northern Ireland Assembly approved funding to replace Northern Ireland Railways' (NIR) oldest Class 80 vehicles with 23 new Diesel Multiple Units (DMUs). However even after this acquisition, much of the remainder of the fleet ranged in age from 19 years to 33 years. Northern Ireland Railways then considered replacement of the remainder of this older fleet which was approaching life expiry.

In addition to the age of its fleet, Northern Ireland Railways identified this as an opportunity to implement a fleet expansion project to support underlying passenger growth and to facilitate further service and associated network development opportunities. This was driven by the Regional Transportation Strategy (RTS) which set out a number of key objectives, including:

- All trains in the 2001 fleet are to be replaced by new trains; and
- Passenger usage (excluding the Enterprise service) to increase by 60% over the 2001 levels by 2011/2012.

In 2001/2002 (the base year for RTS) there were a total of 5.8million journeys (excluding the Enterprise service) which increased to 9.4 million journeys in 2008/2009, representing an increase of about 63%.

The appraisal undertaken of the NTT project concludes that the most suitable Option to carry out is the 'Core Network and Derry service Enhancement'. This option includes the provision of an hourly service on the Belfast to Derry line plus additional peak service to Coleraine. The hourly frequency service to Derry will additionally require construction of a passing loop, possibility in vicinity of Ballykelly or Eglinton plus signalling upgrades.

The Option, which involves enhancements to the core network and increased frequency on the Belfast to Derry line, showed the highest NPV and significant non-monetary and wider economic benefits in the result of the NTT appraisal.

The NTT project forms the basis for the implementation of the Coleraine to Derry Track Renewals Project. It is the NTT project which aims to set in place the new timetable and therefore it is the aim of the Coleraine to Derry Track Renewals Project to ensure that the track along this section has an appropriate infrastructure which will allow for the timetable requirements to be met.

1.4 The Coleraine to Derry Track Renewals Project

The Coleraine to Derry permanent way is typically a minimum of 32 years in service. The signalling system is older still and is largely a token-block system. The permanent way has

deteriorated over time requiring changes to the operational speed on the line for safety reasons. The head of permanent way has reduced the line speed from 70mph to 60mph, supplemented with additional lower temporary speed restrictions. These measures have been implemented in recognition of the asset condition. Failure to carry out significant repairs now will lead to further reductions in line speed. The infrastructure could not offer the necessary performance required to provide the services envisaged by the New Trains Two (NTT) Project.

The Coleraine to Derry Track Renewals Project has therefore been initiated so that the objectives of the NTT project could be met. During the Project Initiation stage the following objectives were identified as key outputs from the proposed renewal project. The following outlines the project in terms of anticipated outcomes:

- Renew track infrastructure to ensure minimum 30 year operational life;
- Recover Permanent Speed Restrictions (PSRs) to 2001 levels;
- Remove Temporary Speed Restrictions (TSRs);
- Upgrade line speed where possible to maximum 90mph;
- Upgrade signalling to current standards;
- Relocate signal cabins at Derry, Castlerock and Portrush to Coleraine;
- Provide infrastructure capacity for hourly train frequency and facilitate future installation for a half hourly service, with a first arrival at Derry before 9am[10];
- Incorporate track and signalling layout to facilitate the development of any new station at Derry;
- Review location of intermediate halts including Park and Ride;
- Ensure signalling compatibility with future GSMR (Global Systems Mobile Communication for Railway); and
- Complete essential signalling works along Portrush branch line.

[10] A 9am arrival is currently unavailable due to infrastructure constraints which is having adverse implications for commuter timetabling between Coleraine, Ballymoney, Ballymena and Belfast

2 Strategic Context

This section of the report considers the particular aims and objectives of key interest groups to ascertain the context within which the project fits. The following have been considered:

- Department for Regional Development (DRD):
  - Regional Development Strategy for Northern Ireland 2025;
  - Regional Transportation Strategy for Northern Ireland 2002-2012;
  - Regional Strategic Transport Network Transport Plan 2015;
  - Accessible Transport Strategy 2015;
- Translink:
  - Review of the Future of Railway in Northern Ireland – Report by the Railways Taskforce;
  - Translink Corporate Plan 2009/2010 – 2011/2012;
  - Translink Passenger Charter;
- Office of the First Minister and Deputy First Minister (OFMDFM):
  - Lifetime Opportunities;
  - Statutory Equality Obligations;
  - Sustainable Development Strategy for Northern Ireland;
- Safety Decision Making (Health and Safety Executive);
- Ilex Regeneration Plan;
- Derry City Council: Annual Report and Improvement Plan 2009/2010; and
- Coleraine Borough Council: Corporate Plan 2009 – 2011.

2.1 Department for Regional Development

The Department for Regional Development (DRD) aims to support the economy by maintaining and developing safe transportation networks. In doing so, it has produced two reports: "Shaping Our Future: Regional Development Strategy for Northern Ireland 2025" and "Regional Transportation Strategy for Northern Ireland 2002-2012".

2.1.1 Regional Development Strategy for Northern Ireland 2025

The Regional Development Strategy (RDS) for Northern Ireland 2025 was published in September 2001. The RDS presents a framework and principles for the development of Northern Ireland over the coming 25 years.

In particular, the Spatial Development Strategy within the RDS proposes to make the best use of key regional assets to accommodate growth including the creation of an upgraded and integrated transport system.

The major transport related themes within the Strategy are:

- Developing a regional strategic transport network;
- Integrating land use and transportation;
- Changing travel culture and contributing to healthy lifestyles; and
- A modern integrated transport system for the Belfast Metropolitan Area.

The RDS recognises that developing a regional transportation system will be a long term challenge and that:

"The medium term objective is to make significant progress over the first ten years towards creating a more integrated system and match best practice."

The RDS included for consideration a number of long term options, such as:

- Upgraded public transport links between the two main cities within the Region – Belfast and Derry – and enhanced Belfast-Dublin Inter-City Links.

In terms of the proposed project, it should improve the track to such a level that it can accommodate the services and timescales envisaged through the NTT project. As a result, it should have a beneficial impact on the rail services provided over this part of the rail network.

2.1.2 Regional Transportation Strategy for Northern Ireland 2002 - 2012

The Regional Transportation Strategy (RTS) is a component part of the overall RDS, and sets out the strategic transportation investment priorities and initiatives over the 10 year period of the plan. In terms of rail, the RTS identified a total of £503 million of investment for rail and identified the following relevant initiatives to this project:

- Maintain and improve the existing rail network;
- Increase patronage by 60% over 2001 levels;
- Additional new rolling stock to provide increased capacity and services (the equivalent of nine new trains); and
- One additional train for the Belfast to Dublin line.

In respect of the lesser used lines, services are to be maintained subject to the successful results from the introduction of new trains and improved infrastructure on the rest of the network.

Under the RTS, Translink would deliver a 'new rail service' that would enhance all aspects of the service experienced by rail passengers, with patronage growth as its core objective. It seeks to encourage and support a public transport service which, in terms of frequency, reliability, comfort and journey time, provides an attractive alternative to private car for journeys within major towns and cities and for journeys between urban centres.

The project has the potential to contribute towards this strategy in terms of improvements to rail services and opportunity for increased passenger numbers.

The proposed project aims to implement improvements to the line between Coleraine and Derry and ensure its useful life is, at minimum, 30 years. The upgrading of this line is expected to

allow for an increase in frequency of service between the stations and hence, could have the potential to increase the number of passengers using the line.

2.1.2.1 Regional Strategic Transport Network Transport Plan 2015

The Regional Strategic Transport Network Transport Plan (RSTNTP) was prepared by DRD and is based on the guidance set out in the RDS and the RTS. The RSTNTP proposes a number of investments in rail and envisages that the lesser used lines be retained and maintained.

Furthermore the RSTNTP set a number of targets/goals to be achieved by 2015 (against the 2001 benchmark) which included:

- To increase the number trips made by rail:
  - 69% increase in train kilometres operated;
  - 67% increase in peak time morning patronage.
- To reduce the use of private cars and hence emissions (Nitrogen Oxide by 63%); and
- Make significant investment in rail safety to minimise accident risk and reduce the possibility of breakdowns affecting public transport journey times.

This project has the potential to assist towards increasing the number of those travelling by rail as it aims to improve the service supplied between Coleraine and Derry through the redevelopment of the line and increased frequency of services.

The current permanent way and the current signalling and telecoms infrastructure assets are life expired. The operational line speed has been reduced from 70mph to 60mph by Translink for safety reasons. If investment is not made in the near future on this route, then the line speed will reduce further and journey times will increase. This project will facilitate the operation of a new hourly timetable, it will the journey times through increased line speeds and it will improve the safety of the track for NIR's passengers and staff.

2.1.3 Accessible Transport Strategy – 2015

In April 2005, DRD published its Accessible Transport Strategy 2015. This strategy has the objective of addressing barriers that prevent older people and those with disabilities from using the transport system and has a vision:

"To have an accessible transport system that enables older people and people with disabilities to participate more fully in society, enjoy greater independence and experience a better quality of life".

This project has the potential to improve accessibility for those who are elderly and disabled through the modernisation of the rail network.

2.2 Translink

2.2.1 Review of the Future of Railway in Northern Ireland – Report by the Railways Taskforce

The Railways Taskforce was established in April 2000 following a major review of railway safety in Northern Ireland (Strategic Safety Review of Northern Ireland Railways – AD Little, March 2000). The Railways Taskforce then commissioned an interim report to provide an illustrative range of options for the future of the rail network in Northern Ireland, in light of the strategic safety review conducted by A D Little.

The Interim Report outlined four strategic options with the aim of highlighting the implications of each of these significantly different investment strategies and hence inform and facilitate the decision making process as to the future role for the railway system in Northern Ireland.

On the basis of this report, the Budget approved by the Assembly in December 2000 provided an additional £102 million over the three year period April 2001 – March 2004 towards the 'consolidation option' outlined in the Railways Task Force Interim Report. This option was based on the following assumptions:

- Discontinuing services on the Antrim to Lisburn Line;
- Consolidation of all the existing network with priority given to the modernisation of the most heavily used lines;
- Replacement of the Class 80 Diesel Multiple Units (DMU'S) fleet with modern DMU train sets;
- Provision of new stations at Templepatrick and Mossley West; and
- Lesser used lines (i.e. north of Ballymena and Whitehead) could continue to operate safely without major investment in the early years of the 10 year railway safety programme produced in 2000 by A D Little, and that their future could be considered most appropriately in the context of the Regional Transportation Strategy.

Translink has managed lesser used lines over a 10 year period of Safety Impairment Programme as envisaged by the Consolidation Option under the Railways Task Force Interim Report. Translink has also achieved the 60% growth target set within the Regional Transportation Strategy confirming the viability of the existing railway network. This project provides the next step in the strategic development of the railways by providing the long term integrity of the Coleraine to Derry track and the facility to deliver the NTT timetable.

2.2.2 Translink's Corporate Plan: 2009/2010 – 2011/2012

Translink's Corporate Plan outlines programmes of work with which it intends to successfully deliver the Government's public transport targets. The programmes below aims to deliver a reformed organisation and structure for Translink best suited to continue growth and development of the business within a changing commercial and policy environment. The programmes include:

- Better Bus Services;

- Great Victoria Street Transport Hub Development;
- Efficiency;
- Integration;
- Commercial;
- Rail Governance;
- New Trains Two; and
- Business as Usual.

Those programmes most relevant to the proposed works being considered within this appraisal are discussed below.

2.2.2.1 New Trains Two Programme

Procure and commission 20 new trains and associated infrastructure to deliver a more attractive network and service to attract more customers.

- Procure, commission and bring into service 20 new trains (replacing 13);
- Put in place a maintenance, supply and collaboration agreement for the new fleet;
- Construct a train maintenance facility for the new fleet; and
- Complete infrastructure upgrades to facilitate increased frequency and service patterns; platform extensions, construction of an additional passing loop between Coleraine and Derry and track relay between Coleraine and Derry.

The proposed project aims to improve the infrastructure of the Coleraine to Derry line to a level that can accommodate the services envisaged within the NTT project. The proposed project has therefore been designed to ensure that the NTT project meets its stipulated objectives.

2.2.2.2 Business As Usual

Ongoing activity streams to support and grow the business. The most relevant aspect of this programme is Translink's commitment to asset renewals which focuses on the renewal of obsolete plant, equipment and infrastructure in an attempt to deliver future planned services and networks effectively and efficiently.

Undertaking the proposed Coleraine to Derry Track Renewals project will ensure there is an appropriate level of improvement to the infrastructure of the current network which will be of a standard that could deliver both existing services and the proposed services envisaged through the implementation of the NTT project.

2.2.3 Translink Action Plan

Two relevant objectives within the Translink Action Plan are as follows:

- *Identify the biodiversity value and potential of our property and establish priorities:* this aims to "quantify, describe and record the natural heritage across the organisation's holdings to ensure that internationally, nationally and locally important habitats and species are identified and valued"; and
- *To raise awareness and understanding of the important of biodiversity both within and outside the organisation:* This aims to effect a change in the corporate culture as well as influence our broader stakeholders, the organisation will promote and educate on issues concerning biodiversity.

The project will adhere to these objectives through promoting any biodiversity works through inclusion in any public consultation (following the award of the letter of offer). The following steps will also to be taken to ensure this objectives is met:

- Ballast will be re-used for the cess walkway;
- Concrete sleepers will be re-used as ballast retaining structure;
- All rail will be recycled; and
- The project will utilise steel sleepers which will facilitate future recycling.

2.2.4 Passenger Charter 2008

The Translink Passenger Charter is a statement of commitment to provide high-quality service which passengers expect to receive on buses and trains in Northern Ireland.

Translink focuses on customers and is committed to continuing to improve every part of their service. The most salient point to note from the Passenger Charter with regards to the rail service is as follows:

"NIR will try to plan services so that, under normal circumstances, passengers should not have to stand during off-peak services. In line with most public transport operators, during peak operating periods, NIR will use all available trains so that no passenger should have to stand for more than 20 minutes".

The proposed project is in line with Translink's Passenger Charter as it aims to improve the rail services and ensure an increased frequency of services between Coleraine and Derry.

2.3 Office of the First Minister and Deputy First Minister – 'Lifetime Opportunities': Government's Anti Poverty and Social Inclusion Strategy for Northern Ireland

This section illustrates how the proposed project is consistent with the Lifetime Opportunities and Section 75 policies.

2.3.1 Lifetime Opportunities

The Government's Anti-Poverty and Social Inclusion Strategy for Northern Ireland ("Lifetime Opportunities") was launched in October 2006. The strategy replaces New Targeting Social Need (New TSN) which was the Government's former high-level policy for tackling poverty

and social exclusion in Northern Ireland. The strategy is structured around a number of general challenges which become the priorities for future policy and action, including:

- Eliminating Poverty;
- Eliminating Social Exclusion;
- Targeting area Based Deprivation;
- Eliminating Poverty from Rural Areas;
- Shared Future – Shared Challenges;
- Tackling Inequality in the Labour market;
- Tackling Health Inequalities; and
- Tackling Cycles of Deprivation.

The proposed project potentially has the ability to assist Translink towards achieving their goal of improving Rail services across Northern Ireland by providing passengers with an increased frequency in service, improvements in the safety of the line and ultimately the provision of train sets which have increased capacity (through the implementation of the NTT project). In particular, due to the rural location of this track, the project will help towards eliminating poverty from rural areas.

2.3.2 Statutory Equality Obligations (SEO)

Section 75 of the Northern Ireland Act 1988, requires organisations to have due regard to the need to promote equality of opportunity in respect of the following "Section 75" groups:

- Persons of different religious belief, political opinion, racial group, age, marital status or sexual orientation;
- Men and women generally;
- Persons with a disability and persons without; and
- Persons with dependants and persons without.

Additionally, and of particular reference to Translink, Public authorities are required to have regard to the desirability of promoting good relations between persons of different religious belief, political opinion or racial group.

This project has the potential to benefit all the users of this network service through improvements to the infrastructure and increased frequency of service with a focus on health and safety issues.

2.3.3 Sustainable Development Strategy for Northern Ireland

The Office of the First Minister and Deputy First Minister (OFMDFM) has recognised the challenge of reducing the volume of greenhouse gases emitted in Northern Ireland. Its vision for Northern Ireland is for it to

"adapt to the impacts of climate change and operate as a highly energy efficient society using a sustainable energy system".

It has three strategic objectives in place:

- To reduce greenhouse gas emissions, principally by promoting energy efficiency and the use of renewables;
- To establish Northern Ireland as a world class exemplar in the development and use of renewable energy; and
- To plan and prepare for climate change impacts in Northern Ireland.

The Office has stated it will ensure that Northern Ireland can meet and exceed its Kyoto Protocol targets of reducing greenhouse gas emissions. The strategy highlights that Northern Ireland has an abundance of renewable energy options available from sources, including wave and tidal, in order to reduce the dependence on imported fossil fuels and this will assist Northern Ireland in becoming more energy sustainable and also provide opportunities for economic progress and support diversification in the rural community.

The proposed project ultimately aims to improve the rail services offered, specifically on this section of the track, through the redevelopment of the line which will then potentially have the ability to provide an increased frequency of services and provide train sets which have increased capacity (through the implementation of the NTT project). This will in turn attract passengers from cars thereby reducing Northern Ireland's carbon footprint.

2.4 Safety Decision Making

The approach to be used to inform the making of safety decisions on Northern Ireland Railways' controlled infrastructure and at stations is based on guidance provided by the Health and Safety Executive (HSE) which introduced the concept of three regions of risk:

- An intolerable region where risks must be reduced;
- A broadly acceptable region where no further risk reduction measures are required; and
- An intermediate region where the cost and trouble of reducing risk further should be weighted against the benefits, to ensure risks are As Low As Reasonably Practicable (ALARP).

This states, in summary, that where risks lie in the ALARP region, decisions on whether to implement further safety measures are guided by balancing the safety benefits of the scheme against the costs of implementation.

Safety benefits are measured in terms of fatalities and injuries avoided, which are converted into an index of equivalent fatalities (i.e. 10 major injuries or 200 minor injuries equals one equivalent fatality). The number of equivalent fatalities avoided is valued by applying an appropriate value of preventing a fatality (VPF).

The risk of an event occurring will typically be based on accident statistics from Great Britain as Translink represents too small a sample size.

It must be stressed however, that this is just one of the considerations that are taken into account when deciding whether to proceed with a safety project or not. In May 1999 the HSE published

a discussion document 'Reducing Risks, Protecting People' which proposed that a greater focus should be placed on the hazard rather than the risk and that society's perception of risk should be considered more. For example there is an aversion to instances, which have the potential for multiple injuries and fatalities.

The Track Renewals project, once completed, will have the required standard of infrastructure to safely accommodate the service improvements envisaged by the NTT project (e.g. increased train set capacity, increased frequency of services). As a result, the proposed project will ensure that safety within the Northern Ireland Railways' Network is improved in terms of the safety of both the passengers and staff'.

2.5 ILEX Urban Regeneration Company – Regeneration Plan

Ilex's role is to plan, develop and sustain the economic, physical and social regeneration of the Derry City Council Area (DCCA). Its mission is:

> *"To create and promote a deliverable vision for the regeneration of Derry, to secure the community's commitment to that vision and to pursue single-mindedly its implementation."*

The Ilex Regeneration Plan for Derry was launched in December 2005 and represents a move towards the provision of a joint economic development and regeneration strategy for all sectors in the North West. The Plan relates to tourism and visitor spend in the local economy. It emphasises the role of the Walled City as a Historical Core Area and commits to working with the Northern Ireland Tourist Board (NITB) and others to develop tourism in the DCCA.

The Regeneration Plan identifies a number of recommended strategies to facilitate rapid growth in the tourism sector and increase share of higher value tourism, mainly through:

- Continued improvement in physical management and safety of the city;
- Focused marketing of city;
- Development of special interest tourism products;
- Enhancement of culinary attractions of city and invitations such as food festivals, restaurant circles, specialist courses etc.;
- Facilitation of tourism attractions on Ilex sites;
- Development of information resource database which would provide information for investors in the tourism sector;
- Enhanced development and management of City of Derry Airport; and
- Improvement of road network.

The Regeneration Plan acknowledges that the Historic Core Zone "*must grow in significance as the focus of city life and as the main visitor attraction*". In spatial terms this will arise through the continued improvement of the public realm and the development of new visitor attractions.

In parallel with developing the Regeneration Plan, Ilex submitted a bid to the Integrated Development Fund (IDF). This bid was built around existing strategies for the development of Northern Ireland and the North West in particular, as reflected in the Regional Development Strategy for Northern Ireland and the National Spatial Strategy for Ireland.

The strategic themes of the Ilex IDF bid are:

- Providing key infrastructure;
- Supporting innovation;
- Encouraging enterprise;
- Stimulating the creative industries; and
- Developing tourism.

The proposed project is being put in place in an attempt to ensure that the aims and objectives of the NTT project can be met. The expectation of improving the infrastructure of the rail service between Coleraine and Derry is to ensure the line has the ability and capacity to meet the increased services offered within the NTT project. These in turn will potentially increase passenger numbers using the service and visiting the City of Derry for business and leisure activities.

2.6 Derry City Council: Annual Report and Improvement Plan 2009/2010

Within its Corporate Plan 2006-2009, Derry City Council identified six strategic outcome areas namely: The Economy, The Environment, Community, Culture and Healthy Living, Regional Leadership, Service Delivery and Organisational Development. Specific objectives and measures of success, along with a range of actions were also identified. The following points highlight the specific objectives associated with each strategic area:

- **The Economy:** A competitive, innovative, regional economy that provides long term and sustainable employment opportunities;
- **The Environment:** A clean, diverse, accessible and sustainable environment for people to enjoy;
- **Community, Culture and Healthy Living:** A culturally rich region made up of confident, safe and healthy communities;
- **Regional Leadership:** Democratically accountable and effective leadership, championing the needs, aspirations and priorities of the region;
- **Service Delivery:** Quality and value for money services, defined by the needs of the region, delivered in an efficient and responsive manner; and
- **Organisational Development:** An innovative organisation with the capacity to meet its current and future needs.

The proposed project is in line with the above improvement plan in that it aims to increase accessibility to the City in order to meet the needs and demands of the local community as well as visitors to the area. It aims to provide a service that can meet future demands.

2.7 Coleraine Borough Council: Corporate Plan 2009 – 2011

The vision of Coleraine Borough Council is:

"Coleraine Borough will be a prosperous, healthy, inclusive and forward looking area in which to live, work and visit".

The values of Coleraine Borough Council are:

- **Transparency:** Open and easily understood;
- **Openness:** Receptive to new ideas;
- **Accessibility:** Easily reached and obtained;
- **Inclusiveness:** Accessible to all;
- **Excellence:** Striving for the highest quality in our services;
- **Integrity:** Complete sincerity and honesty;
- **Equality and Fairness:** Evenly available, impartial, and free of bias; and
- **Accountability:** Answerable and capable of being explained.

The proposed project is in line with the above vision and values of Coleraine Borough Council. The project aims to increase accessibility to Coleraine through the development of a high quality rail service. This has the potential to meet the needs and demands of the local community as well as visitors to the area.

2.8 Conclusion on Strategic Context

The proposed project is in line with many strategies and policies as well as Translink's own vision. The project aims to ensure that the aims and objectives stated within the NTT project can be met through infrastructure improvements which should assist towards providing the increased/improved services outlined within NTT.

The proposed project fits with the strategies and policies outlined above in terms of:

- Modernising the transport infrastructure;
- Bringing the standard of the signalling elements into line with current required standards;
- Ensuring an expected asset life of 30 years;
- Meeting Translink's Sustainability Strategy; and
- Meeting Translink's Safety Strategy.

In terms of the Sustainability Strategy, Translink is committed to providing a sustainable solution for each new project. A sustainable solution is a careful balance between environmental impact, social considerations, capital cost and whole life costs.

3 Identification of Need

3.1 Introduction

This section of the appraisal considers in detail the 'need' for the Coleraine to Derry Track Renewals Project. In making this assessment the current infrastructure, current and future demand and the objectives of the NTT project will be considered in order to assess the demand for train services on this line and therefore the need for implementing the proposed project.

The following section uses information provided through the feasibility study carried out by Arup (2009) and reports by Booz Allen Hamilton carried out in February 2007 and November 2008.

The need for this project has been determined in terms of the following:

- The current Coleraine to Derry Track Infrastructure;
- Booz Allen Hamilton (February 2007)[11]: Assessment of Current and Future Demand;
- Objectives Stipulated within the NTT project and the Booz Allen Hamilton Report (November 2008)[12]: Future Timetable Requirements; and
- NIR's future design timetable for the Belfast to Derry route for operation post the NTT Programme.

3.2 The Current Coleraine to Derry Track Infrastructure

This section of the report will identify the issues with the current Coleraine to Derry line infrastructure which has given rise to the need for implementation of a project of this nature.

3.2.1 Permanent Way

The current Coleraine to Derry track infrastructure dates to approximately 1978 when the last renewal of the permanent way, which consists of the rail, sleepers and ballast, was undertaken. The track is mainly jointed track on concrete sleepers, although there is some continuous welded rail through the tunnels at Castlerock and Downhill.

Financial pressures and a drive to carry out the track relay at minimum cost in the late 1970s lead to a minimum number of sleepers being used in each track panel. Over the following 40 years this has had a negative impact on the asset performance, as the increased sleeper spacing gives rise to poorly supported track joints.

With poorly supported track joints, the cyclic loading associated with a rail vehicle passing over each joint leads, over time, to minor failure of the support which is exacerbated by the increased sleeper spacing. This minor failure reduces the support provided by the sleepers adjacent to the joint, which increases the cyclic loading, leading to further failure. Significant maintenance intervention is required in this scenario to ensure that the constant deterioration of the track does not affect the quality of the permanent way and consequently, the line speed.

[11] Booz Allen Hamilton Report: Business Development Analysis for Northern Ireland Railways (February 2007)
[12] Booz Allen Hamilton Report: Derry to Belfast Infrastructure Capacity Study (November 2008)

During the 1990's minimal funding for Capital Projects led to deterioration in track condition. Then, following adoption of the 'Consolidation Option' of the Railways Task Force Report 2000, which included a closure review, funding for capital works on lesser used railway sections (north of Ballymena and Whitehead) was severely restricted.

Under this policy, the track condition continued to deteriorate between 2000 and 2004 which led to the implementation of a Permanent Speed Restriction (PSR) of 60mph over the entire route from Coleraine to Derry as well as a number of Temporary Speed restrictions (TSRs), all of which impacted train speeds and hence journey time.

Following the Railway Review Group (RRG) report in May 2004 and the subsequent Regional Strategic Transport Network Plan (RSTN) 2015, funding was made available over the following five years (2004/2005-2009/2010) to maintain the integrity of these lesser used sections and 'avoid deterioration in existing service levels', including the route between Coleraine and Derry. Within this funding context, a strategy was developed to maintain the PSR along the route at 60mph through wet bed rectification (ballast and formation repairs) and a number of discreet track dig outs.

Translink has undertaken a programme of wet-bed rectification works to remove approximately 3,000 of the most significant wet spots from the line. However, unless a full renewal is undertaken, existing but less significant wet spots will continue to develop and it is estimated that a further 3,000 wet spots will require rectification in the next three to five year period.

Wet spots affect track stability, impact ride quality and require the imposition of speed restrictions on the line.

Prior to the rectification works, the number of wet spots did increase over time. Given the current condition of the ballast and track drainage it is likely that wet-spots will continue to develop at locations where remedial works have not been undertaken. This will increase in number and develop in size over time.

3.2.1.1 Failures on the Track

The number of failures is roughly in-line with the age and condition of the current permanent way as it reaches end of life. In comparison to new permanent way, the number of failures has increased over time with respect to the "as-laid" condition.

Over the last four year period the number of rail breaks has remained constant at on average one per year. During the ten month period from April 2009 until February 2010 there were 19 separate cases of broken fish plates at the joints on this railway line. The rail breaks have all occurred at the joints. The number of rail failures and fish plate failures have been minimised due to NIR's programme of maintenance which specifically targets the joints. This is aided by NIR's reduction of the operational line speed to 60mph combined with the use of lower intermittent TSRs. If this was not the process adopted at joints and with the line speed on this railway line, then more rail failures and fish plate failures would have resulted.

3.2.1.2 Defects on the Track

All railway track will exhibit rail end defects, such as bowing which is as a result of the current sleeper spacing. In addition, a proportion of the rails also demonstrate metallurgical[13] defects, which require monitoring on an ongoing basis by Translink.

The metallurgical defects could render the rails as unsuitable for re-use in a "crop and weld" heavy maintenance option, as the additional stresses produced by CWR over conventional jointed rail may cause the rail to fail.

The number of defects has increased over time as wear takes place to the track and the infrastructure reaches the end of its design life. The severity of a defect may increase over time i.e. galling at the foot of the rail or metallurgical faults that increase in size with time. These are monitored by Translink using ultrasonic measurement and rails are replaced when the defect becomes safety critical.

Defects on the track therefore resulted in a TSR to 60mph which resulted in the journey time increasing from 38/39 minutes to 45/47 minutes. The new proposed line speed aims to reduce this to 35minutes inclusive of three stops.

The signalling system has not seen any significant capital investment since the late 1980s, whilst the signalling in the vicinity of Waterside Station dates from the late 1970s and Castlerock Station is still signalled by semaphore units dating from the late 1930's. However, minor upgrades have taken place on an ad-hoc basis up to 2009 when the City of Derry Airport signalling interface was installed.

A token block system is used to control the single line between Coleraine and Castlerock and between Castlerock and Derry. This technology allows only one train to operate on each section of line at a time and has a significant impact on line capacity, especially where the block length is considerable, such as between Castlerock and Derry. The provision of a new signalling system, in conjunction with new passing loops would allow a significant increase in the capacity of the line.

The design of the existing signalling layout and interlocking at Castlerock does not comply with current industry best practice and parts of the operating mechanisms are obsolete, making spares harder to source.

The current signalling arrangements between Coleraine, Castlerock and Derry rely on equipment dating from the 1920's linked together with a transmission system manufactured in the early eighties. In practise, if the dated equipment could not be repaired a like for like replacement could not be sourced. Tranlsink have unused, redundant machines that are used for spares. However, failing that, the parts are required to be manufactured. The transmission system has very limited spares held by NIR. All faulty items are repaired even if it is considered uneconomical by the supplier as parts are slowly becoming increasingly difficult to source as they are no longer being manufactured.

Due to the difficultly of sourcing spare parts, when a failure has occurred a temporary block has to be put into place which results in delays to all Derry services with impacting effects on the connecting services to Belfast. In the past, there have been occasions where the failure has taken a number of days to resolve.

[13] This is the technique or science of working or heating metals so as to give them certain desired shapes or properties

The Token and Radio Block system in operation on this line is old and is experiencing end of life intermittent failures regularly. There are Token Block faults occurring as regularly as once a month with interruptions to signalling provision and train services often lasting one to five days. The Radio Block System is maintained using spare systems held by NIR. However, NIR are now in the position where the last spare system is being used to maintain the Radio Block system.

In addition, the current installation does not support the introduction of Automatic Warning System (AWS) or Train Protection and Warning System (TPWS) equipment at this location, as currently required by legislation. An updated installation would support the installation of AWS and TPWS.

The line also lacks a duct route to support the installation of a new signalling system and provide suitable access for the installation of additional equipment or maintenance. However, this has no direct impact on daily operations, however, ongoing maintenance or the introduction of new equipment to maintain operation of the cable infrastructure (specifically where cables are required over significant distances) is time consuming and therefore more costly to implement. In addition, a direct buried cable is more at risk from damage and is prone to removal / theft. In the past Translink has had surface copper signalling cables stolen. Incidents included:

- 1994 GVS to Adelaide, mains power cable stolen within days of installation in a surface troughing duct; and
- 1990/91 Cables strung on a 4 foot high catenary system track side were stolen in the Derry area.

Subsequent to these two events NIR has moved to a standardised system of a ducted buried route and theft has not occurred since this step was taken.

The existing cables are directly buried within the cess areas at the sleeper ends. This has resulted in mechanical damage to the existing cables as a result of NIR's on-track maintenance equipment striking the main cables. As a consequence the operational railway line has then suffered delays as NIR's engineers set about repairing the damaged cables. The delays would normally be confined on the Coleraine to Derry line and would last up to one operational day. Typically, damage such as this, occurs once a quarter.

In addition, point heating devices have not been installed to-date, which would prevent service disruption or cancellation in periods of extreme inclement weather (e.g. when the points in Coleraine froze during the cold spell in January 2010.)

The lack of point heating devices has had minimal impact on the operation of the line in the past. Short delays would have been experienced during inclement weather conditions. However, it is important to give due consideration to the proposed passing loop at Eglinton. Without point heaters located here the impact would be longer delays due to the remote nature of the site and hence, the time it would take employees to travel there in order to manually clear snow or ice from the Track. Also, there are potential health and safety risks to be considered, such as NIR employees being subjected to adverse weather conditions or the risk of slipping on the track.

An incident which recently occurred demonstrates the necessity for point heaters on the track. During January 2010 an isolated set of points at the junction of the railway sidings and the

mainline at Coleraine Depot froze and could not be thawed using Snow Switch (railway "anti-freeze"). The frozen set of points resulted in delays to train services and cancellations to some train services on the Coleraine to Derry Route the Coleraine to Portrush Route and between Central Station and Coleraine.

3.2.2 Bridges

The condition of the bridge structures along this route have been analysed. As a result concrete repairs and waterproofing have been identified as being required on some bridges.

The condition survey has shown that two bridges, (Pottagh and Ballykelly) will need to be replaced within 3 years of the date of completion of the track renewals whilst a third near Myroe (Broharris) needs significant work in the same time frame.

The NIR Structures Department carried out a detailed survey of all culverts and bridges on the line during 2009/2010, which out of the 17 bridges identified three structures requiring major works within the current renewal project timescales. The structures identified were the Pottagh Bridge, the Broharris Bridge and the Ballykelly Bridge.

The bridges currently pass the current assessment standards but it is anticipated that these structures will require intervention within three years of the completion of the renewals project. The replacement decks at Broharris and Ballykelly specifically relate to the current track fixity and this intervention is required to meet the speed requirements of the line.

All bridges assessed pass the current assessment standards however replacements are required at the above three locations as a result of the current track fixity to the bridge (timber waybeam type structures) and as a result of the poor condition of the structures. It is recommended that they will be replaced when the opportunity exists within line closure rather than repaired/strengthened which may only offer a short term solution and possibly result in them being replaced in the near future anyway. This would result in extended line closures and breaking open the newly installed Permanent Way and Signalling and Telecom equipment.

Good practice would suggest that repair works (painting, waterproofing, etc) will ensure the long term integrity of the bridges and that there are significant efficiencies and Value for Money benefits and to carry out the works at this stage when the line is closed and contractors and substitution options are mobilized.

Should the permanent way be replaced at Broharris and Ballykelly locations without bridge works being completed, the bridges would continue to deteriorate as they reach "end of life" and the Structures Department would implement speed restrictions at each structure. Ultimately, the structure would no longer be in a suitable condition to carry rail traffic and the line would be closed until the appropriate work was carried out.

The works would then have to be carried out under one or more blockades; each of these would cause disruption to the passenger service and be subject to programme risk and an associated increase in costs including increased contract duration and bus-substitution/marketing.

If the projects are carried out within the renewal blockade, the line closure, bus substitution and marketing costs as well as contractor preliminaries etc are already included in the main contract; the duration of the bridge replacement works is significantly less than the overall duration of the programmed renewal works and therefore any changes in the programme due to material delivery issues, unforeseen ground conditions or other site issues would not unduly impact the

overall programme and could be accommodated much more easily and at much lower cost than one or more individual stand-alone projects.

Translink recognise the opportunity exists to have these works carried out during the period of the renewal project. If the work was not carried out as part of this project, then the line would require future closures.

3.2.3 Summary

Despite ongoing maintenance, the infrastructure is now reaching the end of its useful life and requires major intervention to guarantee either that existing service levels can be maintained or an improved service can be provided at a future date.

The status of both the permanent way and the signalling system, coupled with the current track layout and lack of passing loops, severely limits the number of trains and their speed between Coleraine and Derry. As a result, the frequency of service is then limited which detrimentally impacts on journey times between Coleraine and Derry.

The condition of the current infrastructure highlights the need for this project as the existing infrastructure does not have the capacity to meet the services proposed within the NTT project. Therefore, without implementation of the proposed project, between Coleraine and Derry, the enhanced services would not be provided and hence, the stated objectives of the NTT project would not be met.

In addition to the above, it is worth considering Northern Ireland's location within the EU. Northern Ireland is at the periphery of the EU and Coleraine and Derry are at the periphery of Northern Ireland. Therefore, it is relatively inaccessible area from the EU as there are no direct modes of transport that would lead directly into Coleraine. As a result, there is a need to ensure that internal transport provision within this region is reliable and accessible to all. It is also proposed that the location of the passing loop should be in a suitable position so that a future park and ride facility could be introduced which would support additional growth in rail patronage figures. However, this is only one minor factor that should be considered in this regard. The timetable requirements are the driving factor behind site selection.

3.3 Booz Allen Hamilton Report (February 2007): Assessment of Current and Future Demand

This section of the report outlines the need for the proposed project through assessment of the current and projected future demand of the rail network with a specific focus on the Belfast to Derry Line and a further analysis of the Coleraine to Derry section of this track where possible.

Current patronage data was taken from the Booz Allen Hamilton (BAH) Report "Business Development Analysis for Northern Ireland Railways" (February 2007) (commissioned by DRD in October 2006). This information was originally supplied by NIR. The forecast passenger demand data is based on the future projections determined by Booz Allen Hamilton (BAH) (February 2007).

3.3.1 Overall Passenger Growth across the Network 2001 - 2009

Passenger numbers for the entire Derry line and the Coleraine to Derry track section are set out in the figure below from 2001 to 2009 with percentage comparisons to 2001/2002 (the RTS base year).

Figure 3.1: Rail Passenger Numbers (2001 - 2009)

Year	Total Derry Line
2001 / 2002	631,029
2004 / 2005	850,056
2005 / 2006	874,954
2006 / 2007	1,020,685
2007 / 2008	1,174,870
2008 / 2009	1,401,745
% Increase from 2001/02 to:	
2004 / 2005	35%
2005 / 2006	39%
2006 / 2007	62%
2007 / 2008	86%
2008 / 2009	122%

Source: Booz Allen Hamilton (February 2007) and Northern Ireland Railways

The analysis provides indication as to the growth experienced in rail passenger numbers, across the Derry line, between the base period 2001/2002 through to 2008/2009.

Over the last three years NIR has experienced a significant increase in the number of passengers using this stretch of line, increasing from 240,000 in 2006/07 to 357,977 in 2008/09 reflecting a 49% increase in passenger usage, which is in line with the significant passenger increase using the whole Derry line (37.3%).

3.3.2 Assessment of Forecast Demand

Using their passenger forecasting model and historic data provided by NIR, BAH (February 2007) estimated future passenger numbers on each line across a number of scenarios. This report is only concerned with the annual passenger growth across the Derry line. The passenger growth rate was determined based on the following factors:

- Underlying economic growth;
- Primary service attributes: trip generation associated with the availability of new travel opportunities;
- Secondary Service attributes: satisfaction effect associated with service improvements such as the introduction of new trains; and
- Stimulated/diverted demand (away from other modes of transport).

The annual passenger expected growth discussed in this report (as taken from the BAH (February 2007) report) was determined based on the following assumptions:

- The 2007/2008 service timetable is maintained without capacity constraints;
- One additional peak hour service from Belfast to Dublin introduced at 9.30am in 2007;
- Fleet replacements so that 2007 timetable can be fully maintained;
- Off-peak services all stopping;
- Half hourly peak frequency Belfast-Ballymena introduced from 2012;
- Portrush line gets new trains, but no "sparkle effect"[14] assumed as the line received new trains in 2006;
- Larne lines get new trains in 2011/2012 and sparkle should be assumed; and
- Journey time improvement on Derry line after track relay in 2013 (six minutes Ballymena-Coleraine and nine minutes Coleraine-Derry).

The model to determine the annual growth rates used the 2004/2005 figures (the base year) and then used the additional years (2005/2006 and 2006/2007) as a means of validation.

*It should be noted that the following uses the annual growth rates determined by BAH (February 2007) but then applies these rates to the 2008/2009 actual usage figure in order to provide an insight into the expected growth pattern from the present time to 2034/2035. The projected annual usage figures in the following table **are not** the figures projected within the BAH (February 2007) report.*

The following table highlights the annual growth rates, determined by BAH (February 2007), for 2009/2010 to 2034/2035 for the Derry line. The annual growth rates have been applied in a year-on-year fashion to provide indication as to the expected annual usage each year up to 2035. The base year used for this analysis is 2008/2009 where the ***actual usage*** figure is known. The growth rate for 2009/2010 has been applied to the 'base year' and then on a year-on-year basis from this point forward. The results are as follows:

[14] The so-called "Sparkle Effect" relates to a one-off stimulation of demand associated with the introduction of a significant upgrade in fleet standards.

Figure 3.2: Projected Annual Usage of the Derry Line (2009/10 – 2034/35)

Year	Projected Annual Growth Rate	Projected Annual Usage
2008/2009 - Actual Figure	**-**	**1,401,745**
2009/2010	1.9%	1,428,378
2010/2011	1.7%	1,452,661
2011/2012	2.7%	1,491,882
2012/2013	1.6%	1,515,753
2013/2014	1.0%	1,530,910
2014/2015	1.0%	1,546,219
2015/2016	1.0%	1,561,681
2016/2017	1.0%	1,577,298
2017/2018	0.8%	1,589,917
2018/2019	0.8%	1,602,636
2019/2020	0.8%	1,615,457
2020/2021	0.7%	1,626,765
2021/2022	0.7%	1,638,153
2022/2023	0.7%	1,649,620
2023/2024	0.6%	1,659,517
2024/2025	0.6%	1,669,474
2025/2026	0.7%	1,681,161
2026/2027	0.6%	1,691,248
2027/2028	0.6%	1,701,395
2028/2029	0.4%	1,708,201
2029/2030	0.5%	1,716,742
2030/2031	0.5%	1,725,325
2031/2032	0.4%	1,732,227
2032/2033	0.4%	1,739,156
2033/2034	0.3%	1,744,373
2034/2035	0.3%	1,749,606

Source: BAH Report (February 2007)

Based on the above analysis it would appear the overall expected growth on the Derry line would be in the region of 25% between the period 2008/2009 to 2034/2035.

3.3.3 Summary

Between the period 2001 to the present time the Belfast to Derry line has experienced a significant increase in the level of passengers. There has been a 122% increase experienced between 2001/2002 and 2008/2009. This increase demonstrates the demand for the Derry line and the increasing usage of this line. Further breakdown of the Coleraine to Derry track section (for 2008/2009) indicates that 26% of passengers travelling on the Derry line travel the full length of the Coleraine to Derry track section.

Projections of the Derry line track usage taken from the BAH report (February 2007) indicate that in 2008/2009 the projected figure would be 1,122,000. However the actual figure recorded was 1,401,745. This indicates that the demand for the Derry line has increased beyond expectations and the projected figure for this period has been exceeded by nearly 300,000 passengers. Applying the expected annual growth rates to the actual 2008/2009 figure shows that, if those rates were achieved there would be an overall growth of 25% between the periods 2008/2009 and 2034/2035.

The above analysis demonstrates the increasing level of demand for the Derry line and more specifically the Coleraine to Derry track section.

3.4 Objectives Stipulated within the NTT project and the Booz Allen Hamilton Report (November 2008): Future Timetable Requirements

In order for the Coleraine to Derry Renewals Project to be successful, it must deliver the requirements of the NTT project with a design life suitable to support the capital funding required.

The future timetable requirements are the key driver of this objective and form the basis for this project.

3.4.1 Train Services to 30th March 2009

For the timetable period from 14th December 2008 until 30th March 2009, the period prior to a line closure between Ballymena and Coleraine for Track Life Extension Project, the service between Belfast and Derry consisted of nine trains daily in each direction (Monday to Saturday) with a reduced service on Sunday.

Average journey time was two hours 15 minutes from Belfast Central to Derry and two hours 20 minutes from Derry to Belfast Central. The table below highlights the number of services between Belfast and Derry during weekdays and at the weekends.

Figure 3.3: Direct Services between Belfast Central and Derry Waterside

Days	Belfast to Derry	Derry to Belfast
Monday to Friday	9	9
Saturday	8	8
Sunday	5	5

3.4.2 Train Services from 27th September 2009

Following improvements between Ballymena and Coleraine, there has been no increase in service frequency, but improvements have been made to the sectional running times between these two stations, which have reduced the average journey time to two hours five minutes from Belfast Central to Derry and two hours eight minutes from Derry to Belfast Central.

At present, the service frequency, which alters significantly throughout the day, and the journey time between Derry and both Coleraine and Belfast, gives rise to unacceptable journey times in relation to alternative modes of transport.

This is not expected to change until new trains procured under the NTT project are in place, which, coupled with the proposed infrastructure improvements between Coleraine and Derry, aims to provide a regular service frequency throughout the day. These trains will be fully in service by 2013.

The following table provides an overview of the average journey times between Belfast and Derry and, Coleraine and Derry.

Figure 3.4: Average Journey Times between Belfast & Derry, and Coleraine & Derry

ode of Transport	Minutes			
	Belfast to Derry	Derry to Belfast	Coleraine to Derry	Derry to Coleraine
Car	93	93	51	51
Bus	100-110	105-115	60-65	65-70
Rail				
Before NTT Project	132	127	-	-
After NTT project	114	120	35	35

3.4.3 Booz Allen Hamilton Report (November 2008): Future timetable requirements

Under the NTT project, Translink identified a requirement to provide an hourly service between Coleraine and Derry in 2012, with the first service from Belfast arriving before 9am. In addition, it was assumed that an enhanced timetable would be provided from 2018 providing a half-hourly shuttle service between the two cities as a stand-alone option from the Belfast to Derry services.

Booz Allen Hamilton (BAH) were commissioned by Translink to review the future timetable requirements of the whole Derry Line from Belfast and identify the future infrastructure and line speed improvements required to achieve an hourly service between the two cities, as well as an optional half-hourly shuttle service between Coleraine and Derry.

The BAH (November 2008) study concluded that two new passing loops would be required. These loops would be required to meet the hourly and half-hourly service requirement. The loop at Castlerock would become redundant.

This would also facilitate Translink's aspiration for additional morning and evening peak express services between Belfast and Derry. The introduction of any new passing loops along the line between Coleraine and Derry would require a complete upgrade of the signalling system to current standards. However, this would permit the rationalisation of signal cabins by consolidating signal control from Castlerock and Derry to Coleraine.

Ballerena halt is the main train service halt to/ from Limavady. It hence is of strategic importance that the halt at Ballerena is maintained to ensure that train services to/ from Limavady during any capital works can continue to operate.

3.4.4 Summary

The requirements of the proposed objectives within the NTT project highlight the need for the implementation of the proposed project as the current infrastructure is of an inappropriate standard or capacity to accommodate the increased services proposed on the Coleraine to Derry track.

Currently, the infrastructure on the Coleraine to Derry track section has diminished to such a level that heavy maintenance work is required in order to keep it operational. With regards to the permanent way the poorly supported track joints have, over time, caused cyclic loading. This often arises when a rail vehicle passes over a poorly supported joint leading to minor

failure of the joint. That failure induces failure in adjacent joints which induces further failures and so on. The increased sleeper spacing causes the joints to be less adequately supported than would be the case if the sleeper spacings were at the recommended values. Hence, the increased sleeper spacing exacerbates the problem of poorly supported joints and contributes to the occurrence of cyclic loading failures. The resulting impact of cyclic loading failures includes:

- Development of wet spots;
- Poor ride;
- Failure of joints;
- Imposition of speed limits; an
- Increased journey time.

The current sleeper spacing causes the rail joints to undergo a cyclical loading. This causes the rails to bow, pumps the ballast and leads to the formation of wet spots. The wet spots exacerbate the cyclical loading, the ride quality reduces and the increased loading at the rail ends cause the rails to bow and in extreme cases, cause the rail to fail.

Without intervention, this process will lead to increasing maintenance requirements over time and the potential of further and increasing speed restrictions.

With regards to the signalling along the track the design of the existing layout and interlocking at Castlerock does not comply with current industry best practice and parts of the operating mechanisms are obsolete, making spares harder to source. In addition, the current installation does not support the introduction of AWS or TPWS equipment at this location, as currently required by legislation.

Heavy maintenance is not a suitable long term solution for either the permanent way or signalling. There is increasing demand on this section of the track and in order to meet the new timetable requirements of the NTT project there is a need to develop an additional passing loop and ensure the track is stable enough to allow for the speed restrictions to be lifted. The proposed improvements will also ensure that the asset will have a minimum life of at least 30 years.

3.5 Potential Economic Benefits

It is important at this stage to highlight that the proposed project may have potential economic benefits associated with its implementation. Such benefits may include the reduction of travel time along the track and the potential to attract more users to the rail service and therefore reduce the number of people travelling by car. This may therefore lead to a reduction in road congestion at peak times throughout the day as well as have associated environmental benefits, such as a reduction in carbon emissions.

Due to the nature of the potential economic benefits discussed above, it can prove difficult to quantify such benefits. As a result, these have been assessed in terms of 'dis-benefits' as a result of the proposed project ***not*** being undertaken. This is discussed further in section six of this report.

3.6 Additionality

A project should not receive assistance if the project objectives would be achieved without public expenditure. In general, assisted projects should receive only the minimum assistance required to bring them about, with any excess over the amount referred to as 'dead-weight'.

Additionality is not solely a matter of a proposal being pursued or not but often partial in the sense that without assistance:

- The proposal may have been carried out in another location of some lower priority;
- The same proposal may be carried out later;
- A different proposal may be carried out or the same project on a smaller scale or to a lower standard of quality; and
- The proposal could receive funding from other Government departments.

In the case of the Coleraine to Derry Track Renewals project, the project will not go ahead without the assistance of this public funding and is therefore considered wholly additional.

3.7 Duplication and Displacement

Displacement is the degree to which an activity promoted by government policy is offset by reductions in activity elsewhere. It is believed that displacement does not occur as a result of the proposed project for the following reason:

- The nature of the project does not entail any cost to any organisation other than Translink.

3.8 Conclusions on Need

The sections above have discussed the findings detailed within the BAH reports and the feasibility study carried out in August 2009. These have indicated that there has been historical passenger growth and there is the potential for future passenger growth. The findings emphasise the need for continuation of the service and in order to continue to provide this service there is a need to ensure that the infrastructure is of an appropriate standard to maintain its asset capacity for the foreseeable future.

Under the NTT project there is an objective to increase the frequency of services in the future. In order to meet the timetable requirements there is a need for track modifications so the line can cope with the proposed additional traffic and hence meet the new timetable. The proposed project aims to implement an appropriate level of changes so that the timetable objectives can be met in the future.

Overall, it is clear that as a result of implementation of the NTT project and the objectives associated with it, there is a need to implement modifications to the track structure of the Coleraine to Derry section of the line in an attempt to create potential for the objectives of the NTT project to be met.

With regards to health and safety there is a need to ensure that the track is maintained at such a level that safety requirements are met for both passengers and staff. If the track does not receive any major capital investment works and is continued to be maintained on an upkeep basis the

track may eventually suffer irreparable damage and will not comply with the health and safety legislation. The repercussions of this could be great in financial and non-financial aspects.

4 Objectives and Constraints

4.1 Introduction

This section of the report sets out the main objectives of Translink and its vision for the Coleraine to Derry Renewals project. The objectives and constraints will provide a benchmark against which the costs and benefits of a variety of options will be subsequently evaluated.

4.2 Translink's objectives

The objectives detailed within Translink's Corporate Plan 2009/2010 – 2011/2012 are designed to assist towards delivering its vision of customer focused growth whilst shaping up for the future. These include:

- To continue to improve rail services;
- To make best use of all assets;
- To enhance the commercial aspects of services;
- To ensure passenger and staff safety; and
- To comply with HMRI (Her Majesty's Railway Inspectorate) standards.

The objectives of the proposed project closely relate to the corporate aims.

4.3 The Coleraine to Derry Track Renewals Project Proposed Aims

The project aims and objectives are in line with the overall aims and objectives of Translink as they are geared towards improving the current rail service and ultimately enhancing the commercial aspects of the rail service.

4.3.1 Key Project Objectives

The key project objectives have been outlined by Translink and are as follows:

- To provide the necessary infrastructure to facilitate the 2012/2013 timetable identified under the NTT project and the Coleraine to Derry Track Renewals Project Initiation Document; and
- To meet the aspirations of the Minister for Regional Development for the rail service to Northern Ireland's second city, with an arrival from Belfast before 9am.

4.3.2 Objectives linked to the Provision of the Key Objectives

These objectives have been set in place in an attempt to ensure that the two key objectives outlined above are met. They are as follows:

- Renew the existing permanent way to current design standards to ensure a minimum 30 year design life;

- Deliver the necessary line speed enhancements to facilitate the requirements of the proposed 2012/2013 timetable by:
  - Recovering PSRs to 2001 levels;
  - Removing TSRs; and
  - Upgrading line speed where possible to a maximum of 90mph.
- Provide the correct passing loop infrastructure to facilitate the requirements of the proposed 2012/2013 timetable;
- Deliver health and safety improvements for the whole line; and
- Renew signalling to current standards.

4.3.3 Further Objectives

These objectives are not required to achieve the key project objectives, but will facilitate ongoing operations, reduce maintenance costs and minimise future capital investment.

- Relocate signal cabins at Derry and Castlerock to Coleraine;
- Identify the correct passing loop provisions to facilitate the requirements of the proposed 2018 timetable;
- Maintain the halt at Bellarena to provide a rail link for Limavady; and
- Facilitate the future provision of a Park and Ride facility in the vicinity of the loop(s) as highlighted in the BAH (November 2008) report.

4.4 SMART Objectives

The following table outlines the SMART (Specific, Measurable, Achievable, Realistic and Timely) objectives of the proposed project.

Figure 4.1: Coleraine to Derry Track Renewals Project - SMART Objectives

SMART Objective	Specific	Measurable	Achievable	Realistic	Timely
Renew track infrastructure to ensure minimum 30 year operational life	**Yes**	**Yes** -Against design standards	**Yes** -No new technologies required	**Yes** -Normal design standard	**May 2013**
Recover PSRs to 2001 levels	**Yes**	**Yes** -Against current permanent speed restriction	**Yes** -New permanent way will remove reasons for PSRs	**Yes** -New permanent way will remove reasons for PSRs	**August 2013**
Remove TSRs	**Yes**	**Yes** -Against current speed restriction	**Yes** -New permanent way will remove reason for TSRs	**Yes** -New permanent way will remove reason for TSRs	**August 2013**
Upgrade line speed where possible to maximum 90mph	**Yes**	**Yes** - Against current permissible speeds	**Yes** -New permanent way will facilitate 90mph	**Yes** -Current speeds limited in many locations by track condition, not alignment	**August 2013**
Upgrade signalling to current standards	**Yes**	**Yes** -Against current signalling standards	**Yes** -Current infrastructure is life-expired	**Yes** -Proven technology proposed	**May 2013**
Provide infrastructure capacity for hourly train frequency and facilitate future installation of a half hourly service with first arrival at Derry before 9am	**Yes**	**Yes** -Against current capacity and timetable	**Yes** -Current timetable modelling and infrastructure proposals based on this requirement	**Yes** -Railway is already in place and sufficient land is available to construct passing loops	**August 2013**
Relocate signal cabins at Derry, Castlerock and Portrush to Coleraine	**Yes**	**Yes** -Consolidation of signalling cabins to one location	**Yes** -Technology proposed will facilitate objective	**Yes** -Similar schemes previously carried out by NIR and timescales sufficient	**May 2013**
Ensure signalling compatibility with future GSMR	**Yes**	**Yes** -Against current signalling standards and	**Yes** -Proven technology currently used in	**Yes** -Timescales are sufficient	**May 2013**

SMART Objective	Specific	Measurable	Achievable	Realistic	Timely
		requirements	GB		
Maintain the halt at Bellarena to provide a rail link for Limavady	**Yes**	**Yes** -To maintain the halt	**Yes** -No change proposed	**Yes** -No change proposed	**May 2013**

4.5 Constraints

The principal constraints associated with the Translink Coleraine to Derry Track Renewals project are set out below:

- **Availability of land (if applicable):** There may be a requirement to acquire additional land in order to extend the platforms. This may be costly, time consuming and there may be regulations to consider;
- **Existing Infrastructure (e.g. bridges, embankments, cuttings, etc):** Thought will need to be given to the existing infrastructure and any modifications which may be required;
- **Regulatory and Planning constraints:** The proposed work to be carried out must comply with relevant legislation and regulations, including Health and Safety legislation;
- **Allocated budget:** The project can only proceed if the appropriate financing is secured; and
- **Time:** The project needs to be completed within a required time frame (by August 2013).

5 Identification of options

This section commences by detailing the long list of options identified by Translink for the implementation of the Coleraine to Derry Track Renewals project. It then discusses the merits and downsides of each of the options and concludes by setting out the options short-listed for in-depth appraisal.

5.1 Identification of long list of options

Having assessed both the need (outlined in Section 3) and the objectives (identified in Section 4), KPMG, in conjunction with Translink, has identified a long list of options for the implementation of the Coleraine to Derry Track Renewals project, details of which are listed below.

Some of the assumptions which have been considered in the option development have included:

- Meet the requirements of the CAA (Civil Aviation Authority) for the de-lethalisation zone of City of Derry Airport with a system that facilitates track maintenance;
- Re-use of existing track is not feasible as it could only facilitate lines speeds of up to 70mph and therefore is not sufficient to accommodate trains running at 90mph;
- A variety of steel and concrete sleepers will be used where appropriate;
- Continuous blockade is the most suitable approach as intermittent blockades and blockades at night would increase the budget significantly and would be an inefficient approach to adopt;
- The proposed Bellarena halt is for a basic structure with DDA compliant access, shelters and signage and will use pre-cast platform units; and
- The overarching factor impacting on the location of the passing loop is the timetable requirements. Loop locations were selected at sites which would ensure the proposed timetable could be met (further detail on this is provided in Appendix 1).

5.1.1 Option 1: Do Nothing

The base case would be “do nothing” to the current infrastructure of the Coleraine to Derry line.

This option involves Translink continuing with the current maintenance regime and the current overall PSR remaining in force. However, it is not envisaged that the current infrastructure of the line would have a lengthy remaining useful life.

Without some level of heavy maintenance the permanent way would continue to deteriorate and would not be able to continue with normal operations as the Permanent Way Engineer will be required to, not only enforce current PSR, but also introduce increasingly more stringent speed restrictions, either at discrete locations or over larger stretches of the line. As a result, the line speed would fall and therefore the journey time would increase until a journey by rail would no longer be viable for passengers.

As a result, passengers would seek alternative modes of transport. The passenger movement away from the rail service between Coleraine and Derry would negatively impact against the

overall provision of the service and eventually, after only a few years, result in the closure of the line. Closing this section of the track does not meet with the key objectives outlined within Translink's objectives or within the NTT project.

*As a result of the above discussion, this option will **not** be taken forward to full appraisal.*

5.1.2 Option 2a: Do Minimum - Heavy Maintenance of the Coleraine to Derry Line

Option 2a would be to carry out heavy maintenance/track life extension works which would extend the life of the permanent way asset for between 10 and 12 years, at which time a full renewal would be required.

This would see the majority of the rail and sleepers reused, with the rail being cropped short and then welded to form continuous welded rail. Complete renewal would be required in a number of discrete locations, including between Coleraine and Castlerock. Signalling improvements would also be required, including the full replacement of the current signalling equipment at Castlerock with a Route Relay Interlocking to interface with the existing systems on the line, along with replacement of the current token block system.

Works could be carried out under night-time engineering possessions only with a limited period blockade or all works could be carried out under blockade. However, this approach would not meet a number of the identified key project objectives namely:

- Renew the existing permanent way to current design standards to ensure a minimum 30 year design life;
- Provide the correct passing loop infrastructure to facilitate the requirements of the proposed 2012/2013 timetable;
- Deliver the necessary line speed enhancements to facilitate the requirements of the proposed 2012/2013 timetable; and
- Meet the aspirations of the Minister for Regional Development for the rail service to Northern Ireland's second city, with an arrival from Belfast before 9am.

There are other impacts with this approach:

- Infrastructure not replaced may reach end-of life within the project timescale, requiring further capital expenditure outside the economic appraisal figure; and
- The project may not eliminate underlying issues in areas that have historically not performed at an acceptable level, further impacting track condition, line speed and the ability to meet timetable requirements.

However, this option is taken forward to appraisal to provide a benchmark against which to compare the full renewal options.

*This option **has** been taken forward to full appraisal.*

5.1.3 Option 2b: Do Minimum - Heavy Maintenance of the Coleraine to Derry Line (excluding new signalling and the implementation of a passing loop)

Option 2b would be to carry out heavy maintenance/track life extension works which would extend the life of the permanent way asset for between 10 and 12 years, at which time a full renewal would be required. This option is similar to that for Option 2a, however, it defers maintenance of the signalling and the implementation of the passing loop at Bellarena.

This would see the majority of the rail and sleepers reused, with the rail being cropped short and then welded to form continuous welded rail. Complete renewal would be required in a number of discrete locations, including between Coleraine and Castlerock.

Works could be carried out under night-time engineering possessions only with a limited period blockade or all works could be carried out under blockade. However, this approach would not meet a number of the identified key project objectives namely:

- Renew the existing permanent way to current design standards to ensure a minimum 30 year design life;
- Provide the correct passing loop infrastructure to facilitate the requirements of the proposed 2012/2013 timetable;
- Deliver the necessary line speed enhancements to facilitate the requirements of the proposed 2012/2013 timetable; and
- Meet the aspirations of the Minister for Regional Development for the rail service to Northern Ireland's second city, with an arrival from Belfast before 9am.

There are other impacts with this approach:

- Infrastructure not replaced may reach end-of life within the project timescale, requiring further capital expenditure outside the economic appraisal figure; and
- The project may not eliminate underlying issues in areas that have historically not performed at an acceptable level, further impacting track condition, line speed and the ability to meet timetable requirements.

This option is not taken forward to full appraisal as it does not meet any of the key objectives of the NTT programme and therefore, is ruled out on this basis.

*As a result of the above discussion, this option will **not** be taken forward to full appraisal*

5.1.4 Option 3a: Full Renewal with One Loop Only (Baseline)

The following table outlines the infrastructure modifications that are proposed under this option.

Option Element	Element Detail
Eglinton	• This loop is required to provide the hourly service between Belfast and Derry; • An 800 metre long static loop will be constructed adjacent to Eglinton AHB Crossing between 87.5MP and 88.25MP; • The track layout will be located within the existing NITHC boundary and will be configured to provide the most advantageous operational layout, including the construction of a new Park and Ride facility at a later date; • To ensure maximum operational flexibility, both lines through the loop will be signalled for bi-directional running; and • A new REB will be provided to control signals and S&C units in the area and will be connected to the new signalling control panel at Coleraine.
Bellarena	• The existing platform at Bellarena will be retained, with the new trackwork located to ensure that a passing loop and new halt can be constructed at a later date; and • The existing Level Crossing will remain as an Automatic Half Barrier (AHB) crossing.
Waterside Station	• This project assumes that the current station at Waterside will be retained; • The renewals project will continue to the existing buffer stops at the station. However, the layout of the signalling and permanent way will be reconfigured to facilitate the relocation of the station an area adjacent to the Ebrington site at a later date with only minor disruption to these elements; and • A new REB will be provided to control signals and S&C units in the area and will be connected to the new signalling control panel at Coleraine.
Castlerock	• The Up platform at Castlerock will be retained as part of this project, whilst the down loop and platform will be removed; • The Up platform will also be extended to facilitate longer trains being provided under the NTT Platform Extension Project, although these works will be funded by the NTT project; • The Signal Cabin at Castlerock will become redundant and will therefore be demolished; and • Works will also be carried out to the existing level crossing to allow remote control from Coleraine Signal Cabin.
Coleraine Station	• Switches and crossings will be renewed; and • Signalling works including the refurbishment of the signal cabin to facilitate the new signalling system and switch and crossing renewals.
Bridge Works	• Waterproofing layer on bridge decks; and • Facilitate refurbishment works to the Bann Bridge at Coleraine.

This option would ensure that the objectives stipulated within the NTT programme and the Coleraine to Derry Track Renewals project are met. As a result, this option is considered to be economically feasible and has therefore been taken forward to full appraisal.

*This option **has** been taken forward to full appraisal.*

5.1.5 Option 3b: Full Renewal (without Bridge Works)

This option will involve the same elements as that for Option 3a, however, it defers bridge works to be completed when necessary.

This option would ensure that the objectives stipulated within the NTT programme and the Coleraine to Derry Track Renewals project are met. As a result, this option is considered to be economically feasible and has therefore been taken forward to full appraisal.

*This option **has** been taken forward to full appraisal.*

5.1.6 Option 4a: Full Renewal with Two Loops including a DDA compliant halt at Bellarena

Option 4a is similar to Option 3a with the exception being that an 800metre long static loop is constructed at Bellarena Halt, in addition to the loop near the Eglinton.

Option Element	Element Detail
Eglinton	• This loop is required to provide the hourly service between Belfast and Derry; • An 800 metre long static loop will be constructed adjacent to Eglinton AHB Crossing between 87.5MP and 88.25MP; • The track layout will be located within the existing NITHCo boundary and will be configured to provide the most advantageous operational layout, including the construction of a new Park and Ride facility at a later date; • To ensure maximum operational flexibility, both lines through the loop will be signalled for bi-directional running; and • A new REB will be provided to control signals and S&C units in the area and will be connected to the new signalling control panel at Coleraine.
Bellarena	• This loop is required to provide the half-hourly service between Coleraine and Derry; • An 800 metre long static loop will be constructed in the vicinity of the existing halt at Bellarena between 74.5MP and 75MP. The track layout will be configured to provide the most advantageous operational layout and to ensure maximum operational flexibility with both lines through the loop signalled for bi-directional running; • A new halt will be constructed immediately to the east of the level crossing at Seacoast Road, which will provide DDA compliant platforms on both legs of the loop. Access between platforms will be provided at grade utilising the level crossing; • The existing platform at Bellarena on the Down side will be removed, as it is sub-standard with regard to platform width and is not DDA compliant; and • All works will be located within the existing NITHCo boundary.
Waterside Station	• This project assumes that the current station at Waterside will be retained; • The renewals project will continue to the existing buffer stops at the station. However, the layout of the signalling and permanent way will be reconfigured to facilitate the relocation of the station an area adjacent to the Ebrington site at a later date with only minor disruption to these elements; • The platform will also be extended to facilitate longer trains being provided under the NTT programme; and • A new REB will be provided to control signals and S&C units in the area and will be connected to the new signalling control panel at Coleraine.
Castlerock	• The Up platform at Castlerock will be retained as part of this project, whilst the down loop and platform will be removed; • The Up platform will also be extended to facilitate longer trains being provided under the NTT Platform Extension project, although these works will be funded

Option Element	Element Detail
	by the NTT project; • The Signal Cabin at Castlerock will become redundant and will therefore be demolished; and • Works will also be carried out to the existing level crossing to allow remote control from Coleraine Signal Cabin.
Coleraine Station	• Switches and crossings will be renewed; and • Signalling works including the refurbishment of the signal cabin to facilitate the new signalling system.
Bridge Works	• Waterproofing layer on bridge decks; and • Facilitate refurbishment works to the Bann Bridge at Coleraine.

This option would ensure that the objectives stipulated within the NTT programme and the Coleraine to Derry Track Renewals project are met. As a result, this option is considered to be economically feasible and has therefore been taken forward to full appraisal.

*This option **has** been taken forward to full appraisal.*

5.1.7 Option 4b: Full Renewal with Two Loops including a DDA compliant halt at Bellarena (without Bridge Works)

This option will involve the same elements as that for Option 4a, however, it defers bridge works to be completed when necessary.

This option would ensure that the objectives stipulated within the NTT programme and the Coleraine to Derry Track Renewals project are met. As a result, this option is considered to be economically feasible and has therefore been taken forward to full appraisal.

*This option **has** been taken forward to full appraisal.*

5.1.8 Option Five: Heavy Maintenance of the Existing Signalling and Telecoms Infrastructure

Currently, the existing signalling and telecoms infrastructure of the track is essentially 'life expired'. Experts within the Signalling and Telecoms Department of Northern Ireland Railways have confirmed that the existing infrastructure is in no way suited to the possibility of a heavy maintenance or life extension type option. However, if such an option was proposed and implemented the Department could not provide any indication as to the expected operational life of the infrastructure. However, they are certain that it would not be in the 10-12 year region which could be achieved through heavy maintenance of the permanent way (Option Two above).

As a result, the Signalling Department have confirmed that, in their expert option, the only viable option for the signalling and telecoms infrastructure is a full new signalling and telecoms network between Coleraine and Derry. This Option would require, to current industry standards, full design, construction, installation, testing and commissioning of work.

As a result of the work necessary for an option such as this, it is felt that it would provide little in terms of economic benefit due to high associated costs and low non-monetary benefits. As a

result of the apparent low economic benefits associated with this Option it is likely that little value would be added to the appraisal in taking this option forward.

*As a result of the above discussion, this option will **not** be taken forward to full appraisal.*

5.2 Shortlisting of Options

Each of the above options has been assessed against the principal objectives and constraints outlined in Section Four. Each option has been assessed in the context of whether its anticipated effect will satisfy the principal objectives or violate important constraints, and the extent to which same will satisfy/violate the screening criteria, to determine which options will be short-listed for in depth appraisal.

Option 1 (Do Nothing) has not been included as a benchmark as NIR will not carry out any maintenance to the track. It would result in the track not meeting the required safety standards and has therefore been eliminated at this stage. Option 2a (Do Minimum) is therefore considered as the benchmark option.

It is concluded that each of the following options will be taken forward to full appraisal:

Option	Description
Option 2a	Do Minimum: Heavy Maintenance
Option 3a	Full Renewal with One Loop Only (Baseline)
Option 3b	Full Renewal with One Loop Only (without the Bridge Works)
Option 4a	Full Renewal with Two Loops including a DDA compliant halt at Bellarena
Option 4b	Full Renewal with Two Loops including a DDA compliant halt at Bellarena (without the Bridge Works)

6 Monetary costs and benefits

6.1 Introduction

This section presents an evaluation of the short-listed options in economic terms. A summary of capital expenditure under each option is set out in the pursuing paragraphs along with details of monetary benefits. In addition, project management costs estimated by Translink and Arup have been included. For the purpose of this appraisal VAT has been excluded from the analysis.

6.2 Revenue and Maintenance Costs

6.2.1 Option 2a: Annual Revenue Costs Post Project Implementation

The annual revenue costs associated with Option 2a relate to general maintenance costs post implementation of the renewals project which are assumed to be the same as existing maintenance costs. It is anticipated that the post renewal annual maintenance costs will be as follows:

Cost Type	Estimated Post Renewals Maintenance Costs (£)
Permanent Way Inspector	27,968
Permanent Way Foreperson	74,038
Permanent Way Trackworker Grade T3	284,353
Permanent Way Trackworker Grade T2	256,894
Tamper & Liner Operator	17,620
Machine Operator	28,595
Kango Hammers	5,000
Plant Hire	50,000
Materials	20,000
Tamper & Liner	12,000
Total	**776,468**[15]

These costs will be incurred for years 1 to 11, after this point a full renewal is required. Once a full renewal has been implemented it is expected the revenue costs will drop to £473,267 per annum running from year 13[16] to year 25.

After year 12 when the revenue costs drop there will be annual saving of £303,201.

6.2.1.1 Signalling and Maintenance Costs During and Post Project Implementation

If Option 2a is implemented there is an estimated total of **£115,810** for signalling maintenance costs. A total of £50,180 will be incurred during the implementation phase of the project (these

[15] It is assumed that the annual revenue costs for this option are the same as the current annual revenue costs
[16] There are no revenue costs incurred during year 12 as this is when a full renewal would have to take place and therefore only capital expenditure would be expected to be incurred during this time

are expected to be incurred during the year 2010) and the remainder (£65,630) will be incurred in the 12 months succeeding project implementation.

6.2.2 Option 3 (a & b) and 4 (a & b): Annual Revenue Costs Post Project Implementation

The annual revenue costs associated with Option 3 (a & b) and 4 (a & b) relate to general maintenance costs post implementation of the renewals project. These costs will be incurred from year one onwards. It is anticipated that the post renewal annual maintenance costs will be as follows:

Cost Type	Estimated Post Renewals Maintenance Costs (£)
Permanent Way Inspector	27,968
Permanent Way Foreperson	46,274
Permanent Way Trackworker Grade T3	197,468
Permanent Way Trackworker Grade T2	142,719
Tamper & Liner Operator	6,407
Machine Operator	12,433
Kango Hammers	5,000
Plant Hire	25,000
Materials	5,000
Tamper & Liner	5,000
Total	**473,267**

Annual revenue costs are currently £776,468. Therefore, after project implementation there will be an annual saving of £303,201 for each option.

6.3 Capital Costs

It should be noted at this point that the project is not due to start until 2011 and therefore the capital costs, which were originally established for a 2009 base year, have been uplifted by an annual inflation factor of 3% to bring them to a rebased cost year of 2011. Capital costs are phased over a 4 year period.

The following capital costs have been provided by Arup and Translink. They include the following (where appropriate):

Permanent Way:	
Remove existing Rails and Sleepers	Welding
Excavate Ballast	Top Ballast
Bottom Ballast	Tamping/Stressing
Lay Sleepers	Switches and Crossings
Lay Rail CWR	Slab Track at CODA
Crop and Weld Works with New Ballast	Top Ballast
Civil Works:	
Remove Castlerock Loop	Cess Walkway
UWCs and LC Works	Culverts
Ducts/Trunking	Fencing
Drainage Materials	Bridges
Property:	
Bellarena Halt (New Construction)	Temporary Relocation of Signalling
	Castlerock Station
Preliminaries:	
Preliminaries – Civil Works	Training
Method Related Charges	Spares
Testing and Commissioning	Unmeasured Items
Other Capital Costs:	
Contractors Fee	Supervision
Preparation	Provision of Temporary Bus Service
Signalling Costs	Electrification and Telecommunications

6.3.1 Sunk Costs: Internal Translink Costs

The following table details the internal Translink costs incurred to date and the future costs that will be incurred (for all options).

Cost Type	Cost Incurred to Date (£)
Project and Cost Management	294,370
Topographical Survey	100,503
Technical Advisor	78,287
Ground Investigation	15,000
S & T Outline Scheme Design	79,748
Economic Appraisal	12,500
CEEQUAL	14,420
Environmental Assessment	12,950
Ecology Walkover	11,380
Track Safety Staff	40,000
NIR Project Co-coordinator	30,000
CDM Co-coordinator	3,928
NIR Signaling PM	20,000
Ext. Gateway Review	4,850
Ilex Preliminary Design	5,000
Laboratory Tests	2,061
Ext. Gateway Miscellaneous	24
Total	**725,021**

The sunk costs have ***not*** been included within the Net Present Cost calculations (Section 9) as they have already been incurred and therefore do not impact on the Net Present Cost. However, these costs form part of the overall costs of the project and have been included within the Option totals. Within each Option the internal Translink costs are included within the "Preparation" and "Supervision" costs. A total of £725,021 for each Option have been determined to be sunk costs and are therefore excluded from the NPC's in Section 9 but included in the overall Option cost. The following Option costs ***exclude*** risk and optimism bias.

6.3.2 Option 2a: Do Minimum – Heavy Maintenance

This option involves Translink continuing with the current maintenance regime and the current overall PSR will initially remain in force. However, without heavy maintenance or a full replacement, the permanent way will continue to deteriorate and the Permanent Way Engineer will be required to introduce increasingly more stringent speed restrictions, either at discrete locations or over larger stretches of the line.

This Option will only extend the life of the permanent way asset for between 10 and 12 years, at which time a full renewal would be required. The table below details the capital costs relating to Option 2a for a 12 year period and is derived from capital cost estimates provided by Arup in terms of the full relay in year 12:

Cost Description	Total (£)
Infrastructure Costs	
P Way	19,289,229
Civil Works	6,405,228
Property	119,591
Preliminaries	4,830,598
Signalling	9,906,047
Electrification and Plant and Telecommunications	2,078,988
Sub-Total	*42,629,681*
Other Capital Costs	
Preparation (at 7.5%)[17]	3,197,226
Supervision (at 3%)[18]	1,278,890
Provision of Temporary Bus Service	926,355
Sub-Total	*5,402,471*
Capital Costs Total	**48,032,152**
Exclude Sunk Costs	(725,021)
Future Cost of Option	**47,307,131**

The cost of Option 2a is £48,032,152:

Future costs totalling: £47,307,131, with associated sunk costs of £725,021.

However, as mentioned above, in year 12 a full renewal will be required. The capital costs associated with this will be £37,917,180. As mentioned in section 6.3.1, after this point the annual revenue costs will reduce to £473,267.

Therefore, the total capital cost of Option 2a is: **£85,949,332 including sunk costs and £85,224,311 excluding sunk costs**.

6.3.3 Option 3a: Full Renewal with One Loop Only (Baseline)

This Option would see most of the elements of the proposed project being carried out but with only one passing loop being developed. All the elements of this project are detailed within section 5.1.4. The table below details the costs relating to Option 3a:

[17] Estimate based on Arup professional judgement
[18] Estimate based on Arup professional judgement

Cost Description	Total (£)
Infrastructure Costs	
P Way	28,981,674
Civil Works	9,348,314
Property	119,591
Preliminaries	7,168,173
Signalling	9,906,047
Electrification and Plant and Telecommunications	2,078,988
Sub-Total	*57,602,787*
Other Capital Costs	
Preparation (at 6%)	3,456,167
Supervision (at 2%)	1,152,056
Provision of Temporary Bus Service	926,355
Sub-Total	*5,534,578*
Capital Costs Total	**63,137,365**
Exclude Sunk Costs	(725,021)
Future Cost of Option	**62,412,342**

The cost of Option 3a is £63,137,365:

Future costs totalling: £62,412,342, with associated sunk costs of £725,021.

Bridge Costs:

The NIR Structures Department carried out a detailed survey of all culverts and bridges on the line during 2009/2010, which out of the 17 bridges identified three structures requiring major works within the current renewal project timescales. The structures identified were the Pottagh Bridge, the Broharris Bridge and the Ballykelly Bridge.

Current cost estimates (construction elements only) for the replacement structures at each of the locations highlighted are as follows:

- Replacement Deck at Pottagh (associated cost of £250,000 (consideration to be given to Armco pipe structure));
- Replacement Deck at Broharris (associated cost of £300,000); and
- Replacement Bridge at Ballykelly (associated cost of £150,000).

It should be noted that the replacements proposed at Broharris and Ballykelly relate to structural and track fixity issues and as such are linked to potential speed restrictions and hence the ability to deliver the brief.

In addition a further £1.04million of essential maintenance (required within a three year period from the completion of the renewals project) are planned as follows:

- Concrete Repairs;
- Steelwork Repairs;
- Deck Waterproofing;

- Scour protection;
- Painting;
- Miscellaneous Works; and
- Culvert Replacement works.

6.3.4 Option 3b: Full Renewal with One Loop Only (without the Bridge Works)

This Option remains the same as that for Option 3a, however the bridge works have been deferred for a period of five years from the initial implementation of this option. All the elements of this project are detailed within section 5.1.5. The table below details the costs relating to Option 3b:

Cost Description	Total (£)
Infrastructure Costs	
P Way	26,346,976
Civil Works	6,814,001
Property	108,719
Preliminaries	6,204,894
Signalling	9,005,497
Electrification and Plant and Telecommunications	1,889,989
Sub-Total	*50,370,076*
Other Capital Costs	
Contractors Fee (at 10%)	5,037,007
Preparation (at 6%)	3,324,425
Supervision (at 2%)	1,108,142
Provision of Temporary Bus Service	926,355
Sub-Total	*10,395,929*
Capital Costs Total	**60,766,004**
Exclude Sunk Costs	**(725,021)**
Future Cost of Option	**60,040,983**

The cost of Option 3b is £60,766,004:

Future costs totalling: £60,040,983, with associated sunk costs of £725,021.

However, as mentioned previously, in year 5 construction of the bridge will be required. This will have an associated cost of £4,370,984[19] which will include capital construction elements as well as the associated cost of lifting up sections of the track.

Therefore, the total capital cost of Option 3b is: **£65,136,988 including sunk costs and £64,411,967 excluding sunk costs**.

[19] A full breakdown of this cost is attached in Appendix 2

6.3.5 Option 4a: Full Renewal with Two Loops including DDA Compliant Halt at Bellarena

This Option would include the same elements as those for Option 3a with an additional loop at Bellarena and a DDA compliant halt at Bellarena. All the elements of this project are detailed within section 5.1.4. The table below details the costs relating to Option 4a:

Cost Description	Total (£)
Infrastructure Costs	
P Way	29,881,751
Civil Works	9,348,314
Property	1,463,816
Preliminaries	7,583,366
Signalling	11,292,213
Electrification and Plant and Telecommunications	2,078,988
Sub-Total	*61,648,448*
Other Capital Costs	
Preparation (at 6%)	3,698,907
Supervision (at 2%)	1,232,969
Provision of Temporary Bus Service	926,347
Sub-Total	*5,858,223*
Capital Costs Total	**67,506,671**
Exclude Sunk Costs	(725,021)
Future Cost of Option	**66,781,650**

The cost of Option 4a is £67,506,671:

Future costs totalling: £66,781,650, with associated sunk costs of £725,021.

6.3.6 Option 4b: Full Renewal with Two Loops including DDA Compliant Halt at Bellarena (without the Bridge Works)

This Option remains the same as that for Option 4a however the bridge works have been deferred for a period of five years from the initial implementation of this option. All the elements of this project are detailed within section 5.1.7. The table below details the costs relating to Option 4b:

Cost Description	Total (£)
Infrastructure Costs	
P Way	27,165,228
Civil Works	6,814,001
Property	1,330,742
Preliminaries	6,582,345
Signalling	10,265,648
Electrification and Plant and Telecommunications	1,889,989
Sub-Total	*54,047,953*
Other Capital Costs	
Contractors Fee (at 10%)	5,404,795
Preparation (at 6%)	3,567,165
Supervision (at 2%)	1,189,055
Provision of Temporary Bus Service	926,347
Sub-Total	*11,087,362*
Capital Costs Total	**65,135,314**
Exclude Sunk Costs	**(725,021)**
Future Cost of Option	**64,410,293**

The cost of Option 4b is £65,135,314:

*Future costs totalling: £64,410,293, with associated sunk costs of £725,021.*However, as mentioned previously, in year five construction of the bridge will be required. This will have an associated cost of £4,370,984 which will include capital construction elements as well as the associated cost of lifting up sections of the track.

Therefore, the total capital cost of Option 4b is: **£69,506,298 including sunk costs and £68,781,277 excluding sunk costs**.

6.3.7 Annual Breakdown of Capital Costs

The table below shows an annual breakdown of the capital costs identified for each option. Note that the capital costs below ***exclude*** optimism bias. The costs incurred in 2009/2010 represent the internal Translink costs which have already been incurred (i.e. the sunk costs).

Option	09/10 (£)	10/11 (£)	11/12 (£)	12/13 (£)	13/14 (£)	15/16 (£)	22/23 (£)	Total Capital Cost (£)
2a	725,021	2,392,534	6,220,587	36,605,765	2,088,241	-	37,917,180	**85,949,332**
3a	725,021	3,150,549	8,821,537	47,258,236	3,182,017	-	-	**63,137,365**
3b	725,021	3,031,975	8,489,528	45,479,617	3,039,862	4,370,984	-	**65,136,987**
4a	725,021	3,369,026	9,433,274	50,535,395	3,443,953	-	-	**67,506,670**
4b	725,021	3,250,453	9,101,266	48,756,783	3,301,791	4,370,984	-	**69,506,298**

6.4 Summary of Options Costs

The table below shows a summary of the costs identified for each option. Note that the capital costs below ***exclude*** optimism bias.

Option	Sunk Costs (£)	Initial Capital Outlay (excl Sunk Costs) (£)	Annual Revenue Cost Post Implementation (Post yr 12) (£)	Signalling and Maintenance Costs (£)	Additional Capital Required in Year 5/12 (£)
2a	725,021	47,307,131	776,468 (473,267)	115,810	37,917,180
3a	725,021	62,412,342	473,267	-	-
3b	725,021	60,040,983	473,267	-	4,370,984
4a4a	725,021	66,781,650	473,267	-	-
4b	725,021	64,410,293	473,267	-	4,370,984

6.5 Economic Dis-benefits

This section details further economic dis-benefits associated with Option 2a. While it is imperative to consider the tangible financial cost of the project in terms of associated revenue and capital costs it is also important to consider any related economic dis-benefits that may result due to option implementation.

In order to consider this the "Transport Analysis Guidance" provided by the Department for Transport was used ("Webtag"). These guidelines detail how to conduct an appraisal of transport projects. The guidance advises on:

- Setting objectives and identifying problems;
- Developing potential solutions;
- Creating a transport model for the appraisal of the alternative options; and
- How to conduct an appraisal which meets the Department's requirements.

For this appraisal it is appropriate to consider the dis-benefits associated with Option 2a. Benefits for Options 3 (a & b) and 4 (a & b) have not been considered as the increase in passenger numbers cannot be solely attributable to the Track Renewals project.

For this appraisal the following categories were considered:

- Impacts of time savings; and
- Vehicle operating costs.

The following assumptions were applied in carrying out the economic dis-benefit analysis:

- Journey time would increase if full renewal not undertaken;
- The project would not meet the overall objectives of the NTT project;
- There would be an increase in maintenance costs; and
- Further capital costs would be incurred over time such as costs to replace bridges at a later date including bus substitution and additional marketing expenses.

The table below highlights the economic impacts for the above categories for Option 2a.

Category	Option Two (£)
Time Savings	(328,134)
Vehicle Operating Costs	(13,621)
Total Benefit/(Cost)	**(341,755)**

The dis-benefits have been included within the NPC calculation in Section 9 and a full breakdown of the calculations is attached in Appendix 3.

6.6 Residual Value (Option 2)

A residual value is included in Option 2 for the full relay constructed in Year 12 of the appraisal period, based on a 30 year asset life consistent with other options. In line with standard convention, this residual value is calculated on a Depreciated Replacement Cost basis and included in the final year of the appraisal period.

7 Optimism bias, risk and uncertainty

7.1 Introduction

Risks associated with any project are a combination of project specific risks and those on a wider macro-economic scale. Project specific risks are those that directly affect the project and which the project promoters should have a high level of knowledge and associated level of control over. Wider macro-economic/local risks are those that are beyond the control of project promoters yet can significantly influence the success of the project (e.g. economic climate). The following risks (including Optimism Bias) have been identified and outlined below as to their possible effect on the various options.

7.2 Identification and Analysis of Risks

Risk on this project is identified and managed using Translink's "Risk Management Procedure". Risks are identified and shared by the appropriate parties on the Project Team encouraging a positive attitude to the eradication or mitigation of identified risks.

Two project risk workshops were carried out during the feasibility stage to identify project risks. At the first risk workshop the risks were identified and the probabilities and impacts were qualified. At the second risk workshop the cost and programme impacts of the risks were quantified. At both workshops mitigation measures were developed.

Risks were reviewed regularly throughout the latter parts of the feasibility stage and will continue to be monitored through the project lifecycle.

A copy of the Risk Register is included in Appendix 4 to this appraisal.

7.3 Optimism Bias

7.3.1 Introduction

The Green Book (2003) states that there is a demonstrated, systematic tendency for project appraisers to be overly optimistic, referred to as 'optimism bias', and to redress this tendency, there is a requirement that appraisals make explicit, empirically based adjustments to the estimates of project costs, benefits and duration.

The adjustments are based on recommendations made in the Green Book and supplementary guidance, which recommends that these adjustments be based on data from past or similar projects, and adjusted for unique characteristics of the project in hand.

Supplementary Green Book guidance provides adjustment percentages for optimism bias in generic project categories in relation to capital expenditure and works duration. These have been prepared from a study by Mott McDonald into the size and causes of cost and time overruns in past projects. This demonstrates Translink's previous knowledge and experience of capital projects of this nature and making adjustments for unpredictable occurrences.

7.3.2 Selection of project category

The proposed Coleraine to Derry Track Renewals project is considered to be 'Standard' as it is based on well established engineering work with which Translink has experience. As such, the improvement works can be categorised as a **Standard Civil Engineering Project**.

7.4 Capital expenditure Optimism Bias

7.4.1 Optimism Bias for the Coleraine to Derry Track Renewals Project

The optimism bias for capital expenditure on a standard civil engineering project is 44%. The optimism bias factor can be reduced, depending on the extent to which the risks that lead to optimism bias, known as 'contributory factors', are managed.

The extent to which the contributory factors are mitigated is reflected in a mitigation factor. The mitigation factor has a value between 0.0 and 1.0. Where 0.0 means that contributory factors are not mitigated at all and 1.0 means that all contributory factors in a particular area are fully mitigated. Optimism bias is reduced in proportion to the amount that each factor has been mitigated.

Contributory factors in the following table have been selected as factors applicable to the project being appraised. They have been selected from factors listed in the Supplementary Green Book Guidance. Each factor's relevant percentage contribution to optimism bias is specified in the Supplementary Green Book Guidance.

7.4.1.1 Optimism Bias for Option 2a

The following table details the contributory factors and the mitigation factors considered for the calculation of Optimism Bias for Option 2a.

Contributory factor	%	Mitigation factor	Result (%)
Late contractor involvement in design	3	0.2	0.6
Dispute and claims occurred	21	0.4	8.4
Environmental Impact	22	0.1	2.2
Other	18	0.5	9.0
Inadequacy of the business case	10	0.5	5.0
Poor project intelligence	7	0.5	3.5
Public relations	9	0.1	0.9
Site characteristics	3	0.1	0.3
Economic	7	0.1	0.7
Total	**100**		**30.6**

Resultant capital expenditure optimism bias =

(100% - 30.6%) x 44% = 30.5%.

7.4.1.2 Optimism Bias for Options 3(a & b) and 4(a & b)

The following table details the contributory factors and the mitigation factors considered for the calculation of Optimism Bias for Options 3(a & b) and 4(a & b).

Contributory factor	%	Mitigation factor	Result (%)
Late contractor involvement in design	3	0.4	1.2
Dispute and claims occurred	21	0.4	8.4
Environmental Impact	22	0.4	8.8
Other	18	0.8	14.4
Inadequacy of the business case	10	0.7	7.0
Poor project intelligence	7	0.7	4.9
Public relations	9	0.6	5.4
Site characteristics	3	0.4	1.2
Economic	7	0.4	2.8
Total	**100**	**-**	**54.1**

Resultant capital expenditure optimism bias =

(100% - 54.1%) x 44% = 20.2%.

7.4.2 Risk management and risk reduction strategies

The following are examples of the proposed strategies for risk management and risk reduction for the proposed Coleraine to Derry Track Renewals project:

- ***Late contractor involvement in design*** – The contractor for the project has not been appointed as yet and a tender process will need to take place in order to determine the most suitable candidate for the position. A technical advisor was engaged at the feasibility stage and he commented on the programme, cost and construction methodology of the scheme. ***This risk has been assessed as been assessed as high for all options***.
- ***Dispute and Claims Occurred –*** Whilst detailed surveys, site investigation and designs have been prepared there remains a risk of dispute and claims occurring due to various factors, e.g. the number of different sites across the network, weather conditions and site contamination. ***This risk has been assessed as been assessed as high for all options***.
- ***Environmental –*** The implementation of the proposed project has the potential to have environmental impacts. Translink has undertaken an environmental appraisal of the proposed areas and are in discussions with the Northern Ireland Environment Agency (NIEA). ***This risk has been assessed as been assessed as high for all options***.
- ***Other –*** This could include such risks like strategic issues which will impact on the direction of the project, operational issues such as an unexpected decrease in passenger numbers. These risks have been considered in detail in the attached risk register and mitigation techniques have been set in place. ***This risk has been assessed as been assessed as low for options 3(a & b) and 4 (a & b) and medium for option 2a***.
- ***Inadequacy of the Business Case –*** This project has been under consideration for an extensive period of time. As a result careful consideration has been given to all relevant factors of the proposed project and hence a mitigation factor of 0.7 has been awarded. ***This risk has been assessed as been assessed as medium for all options***.
- ***Poor Project Intelligence –*** The needs and recommendations for the proposed project have been considered. As such, the proposed project has been awarded a mitigation factor of

0.70 in this respect. ***This risk has been assessed as been assessed as medium for all options***.

- ***Public Relations –*** Translink needs to ensure that the surrounding public within the relevant locations are informed and aware of the proposed project and any issues with regards to local noise pollution or any proposed delays to services as a result of the project should be communicated prior to the project being undertaken. ***This risk has been assessed as been assessed as medium for options 3(a & b) and 4 (a & b) and high for option 2a***.
- ***Site Characteristics –*** Arup engineering consultants have carried out a feasibility study and, to date, there have been no concerns in relation to site characteristics. However, due to the nature of the project there is remaining risk that there may be issues with regards to some of the site characteristics which could cause potential problems for the proposed project. ***This risk has been assessed as been assessed as high for all options***.
- ***Economic factors*** –The level of funding for the proposed project will be determined by this Economic Appraisal. With construction prices liable to change in the future due to the current economic climate, any delays in approval or proceeding to the full design stage could have cost implications. ***This risk has been assessed as been assessed as high for all options.***

7.4.3 Results of adjustment for optimism bias on capital costs

The following table illustrates the capital costs for each option, taking into account optimism bias ***(excluding £725,021 of sunk costs)***:

Category	Option 2a	Option 3a	Option 3b	Option 4a	Option 4b
Expenditure (excluding sunk costs)	85,224,306	62,412,342	64,411,966	66,781,650	68,781,276
Optimism Bias (30.5% / 20.2%)	25,993,413	12,607,293	13,011,217	13,489,893	13,893,818
Capital Adjusted Cost (£)	**111,217,719**	**75,019,635**	**77,423,183**	**80,271,543**	**82,675,093**

7.5 Works Duration Optimism Bias

The optimism bias for works duration on a standard engineering project is 20%. The optimism bias factors can be reduced, depending on the extent to which the risks that lead to the contributory factors are managed in the same manner as the optimism bias factors for capital expenditure. Mitigation factors are applied to the contributory factors which have values between 0.0 and 1.0.

Contributory factors have been selected as factors applicable to the project being appraised. They have been selected from factors listed in the Supplementary Green Book Guidance.

The following table outlines the work duration optimism bias for standard engineering projects i.e. the Coleraine to Derry Track Renewals Project:

Contributory factor	%	Mitigation factor	Result (%)
Poor Contractor Capabilities	16	0.9	14.4
Environmental Impact	46	0.8	36.8
Inadequacy of the Business Case	8	0.7	5.6
Funding Availability	6	0.2	1.2
Poor Project Intelligence	14	0.7	9.8
Site Characteristics	10	0.3	3.0
Total	**100**	**-**	**70.8**

The adjusted works duration for the Coleraine to Derry Track Renewals Project is therefore:

(100% - 70.8 %) x 20% = 5.8%

This is illustrated for each option as follows:

	Option 2a	Option 3a	Option 4b	Option 4a	Option 4b
Initial project duration	104	78	78	78	78
Work duration optimism bias (@5.8%)	9	4.5	4.5	4.5	4.5
Optimised project duration (weeks)	**113**	**82.5**	**82.5**	**82.5**	**82.5**

As such, this indicates a minimal delay in completing the Coleraine to Derry Track Renewals Project if contributory factors are effectively managed.

7.6 Conclusion

Having applied optimism bias in relation to capital expenditure and works duration to each of the above Options, it is apparent that there are potential associated over-runs with each option.

8 Non-monetary costs and benefits

8.1 Introduction

It is often difficult to apply a monetary value to some of the costs and benefits associated with each of the options. These non-monetary costs and benefits should not be discounted as being any less important than the monetary values, indeed in many cases they are crucial in the decision making process. Therefore a suitable method of evaluating these non-monetary factors must be applied. For the purpose of this appraisal the weighted scoring approach is applied. This section begins by discussing the weighted scoring methodology and then proceeds to discuss the rationale underlying the scores awarded to each of the short-listed options.

8.2 Weighted Scoring Approach

The weighted scoring approach involves assigning numerical weights to pre-defined "benefit criteria", chosen to correspond to the needs and objectives of the proposed project, outlined in Sections 3 and 4 in this appraisal. Each option is then given a score against each of the different benefit criteria, accumulating in an overall weighted score for each option. The following sub-sections outline the rationale behind both the weights applied to the benefit criteria and the scores awarded to each option.

8.2.1 The weighting of the objectives

The benefit criteria are as follows:

- ***Criterion One:*** Ability to meet NTT and Translink objectives with regards to the future 2012/2013 timetable requirements;
- ***Criterion Two:*** Ability to allow, an arrival in Derry from Belfast before 9am;
- ***Criterion Three:*** Ability to improve the health and safety aspects of the track and upgrade for DDA compliance;
- ***Criterion Four:*** Ability to ensure that the current infrastructure is upgraded to ensure a lifespan of 30 years (minimum);
- ***Criterion Five:*** Ability to ensure the signalling is upgraded to current required safety standards; and
- ***Criterion Six:*** Carry out other major works that require a possession or blockade (this will ensure that no works requiring possession will be required for five years from the date of reopening following renewal).

The Guidance on Methods for Multi-Modal Studies recommends that options are scored against non monetary criteria considering:

- ***Safety:*** dealt with under Criteria Three and Five above;
- ***Accessibility:*** dealt with under Criteria One, Two and Three above;
- ***Integration:*** dealt with under Criteria One and Two above;

- ***Environment***[20]***:*** dealt with under Criteria Three and Five above; and
- ***Wider economic benefits:*** dealt with under Criteria One, Two, Four and Six above.

Each benefit criterion was weighted to give a total score of 100 for all five criteria with the most important receiving the greatest weighting. Each of the short listed options was then scored out of 10 against each benefit criterion and this score multiplied by the allocated weighting to produce a "weighted score." The total weighted score for each option was compared to give a qualitative ranking.

In summary, the weighting for each benefit criterion may be detailed as follows:

Benefit criteria		Weighting
Criteria 1	Ability to meet NTT and Translink objective with regards to the future 2012/2013 timetable requirements	20
Criteria 2	Ability to allow an arrival in Derry from Belfast before 9am	20
Criteria 3	Ability to improve the health and safety aspects of the track and upgrade for DDA compliance	20
Criteria 4	Ability to ensure that the current infrastructure is upgraded to ensure a lifespan of 30 years (minimum)	10
Criteria 5	Ability to ensure the signalling is upgraded to current required standards	10
Criteria 6	Carry out other major works that require a possession or blockade	20
Total		**100**

8.2.2 The weighting of benefit criteria

Criteria One, Two, Three and Six are considered to be the most critical to the purpose and success of this project, and have therefore been given a weighting of 20. Ability to meet the timetables and schedules proposed under the NTT project, to arrive in Derry before 9am, to comply with DDA requirements and carry out other major works that require a possession or blockade, are paramount to Translink and the implementation of this project.

Criteria Four and Five are given the joint second highest ranking and allocated a weighting of 10 each as they are considered important but rank below safety and accessibility of the services.

8.2.3 The Scoring of the options

This section details each of the options score against the non-monetary criteria.

8.2.3.1 Benefit Criterion One: Ability to meet NTT and Translink objectives with regards to the future 2012/2013 timetable requirements

Summarised in the table below are the scores that have been awarded to each option under benefit criterion one:

[20] This relates to the reduction of accidents and to improve safety in respect of this GOMMMS

Option	Description	Score
2a	Do Minimum: Heavy Maintenance	0
3a	Full Renewal with One Loop Only	10
3b	Full Renewal with One Loop Only (without Bridge Works)	8
4a	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena)	10
4b	Full Renewal with Two Loops (including a DDA compliant station at Bellarena) (without Bridge Works)	8

Option 2a scores zero under this benefit criterion as it involves no upgrade to the track to ensure that an increased frequency of service can occur and therefore does not contribute towards this non-monetary criteria.

Both Options 3a and 4a score ten as they have the greatest potential to meet all of the timetable objectives of this project. Options 3b and 4b score eight under this criteria as, although they would have potential to meet the timetable requirements, in 2014/2015 the bridge would be implemented which would result in disturbance to the track and hence, disruption to the timetable and increased travelling time on the line with possible bus substitution measures being required.

8.2.3.2 Benefit Criterion Two: Ability to allow an arrival in Derry from Belfast before 9am

Summarised in the table below are the scores that have been awarded to each option under benefit criterion two:

Option	Description	Score
2a	Do Minimum: Heavy Maintenance	0
3a	Full Renewal with One Loop Only	10
3b	Full Renewal with One Loop Only (without Bridge Works)	8
4a	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena)	10
4b	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena) (without Bridge Works)	8

Option 2a scores zero under this benefit criterion as it involves no upgrade to the track to ensure that an increased frequency of service can occur and therefore does not contribute towards this non-monetary criteria.

Under this criterion both Options 3a and 4a score ten as they aim to upgrade the Coleraine to Derry track to allow for an improvement in train times and allow for an increased frequency in services. Options 3b and 4b score eight under this criteria as although they would have potential to allow for an arrival at 9am in Derry, in 2014/2015 the bridge would be implemented which would result in disturbance to the track and hence, disruption to the timetable, therefore not allowing for the 9am arrival in Derry. However, before and after the bridge was implemented the Options would allow for a 9am arrival in Derry.

8.2.3.3 Benefit Criterion Three: Ability to improve the health and safety aspects of the track and upgrade for DDA compliance

Summarised in the table below are the scores that have been awarded to each option under benefit criterion three:

Option	Description	Score
2a	Do Minimum: Heavy Maintenance	6
3a	Full Renewal with One Loop Only	9
3b	Full Renewal with One Loop Only (without Bridge Works)	7
4a	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena)	10
4b	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena) (without Bridge Works)	7

Option 2a scores six and Option 3a scores nine under this criteria as they will improve the health and safety aspects of the track but they will not involve an upgrade to the Bellarena halt to ensure it complies with DDA compliance and therefore score lower than Option 4a.

Option 4a scores ten under this criteria as it aims to address health and safety features of the track as well as upgrade the Bellarena halt to DDA standards.

Both Option 3b and 4b score seven as they will upgrade some health and safety aspects of the track but with the omission of the bridges which therefore negatively impacts on the score for this criterion.

8.2.3.4 Benefit Criterion Four: Ability to ensure that the current infrastructure is upgraded to ensure a lifespan of 30 years (minimum)

Summarised in the table below are the scores that have been awarded to each option under benefit criterion four:

Option	Description	Score
2a	Do Minimum: Heavy Maintenance	4
3a	Full Renewal with One Loop Only	10
3b	Full Renewal with One Loop Only (without Bridge Works)	10
4a	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena)	10
4b	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena) (without Bridge Works)	10

Option 2a scores four under this benefit criterion. The initial project will renew the track for a further 10 to 12 years and after this point a further injection of capital funds will be required for a full renewal which will extend the life of the track to 30 years. The Option scores four as its ability to extend the life of the track to 30 years is dependent on the further injection of capital.

Options 3 (a & b) and 4 (a & b) score ten under this criteria. These Options will ensure an improved life of the track and ensure the infrastructure of the track will have a lifespan of a minimum of 30 years.

8.2.3.5 Benefit Criterion Five: Ability to ensure the signalling is upgraded to current required standards

Summarised in the table below are the scores that have been awarded to each option under benefit criterion five:

Option	Description	Score
2a	Do Minimum: Heavy Maintenance	6
3a	Full Renewal with One Loop Only	10
3b	Full Renewal with One Loop Only (without Bridge Works)	10
4a	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena)	10
4b	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena) (without Bridge Works)	10

Option 2a scores six under this benefit criterion as it involves some work to the signalling and therefore there is some potential for it to be compatible with future technologies.

Options 3 (a & b) and 4 (a & b) score ten. Within these options, there is an aim to ensure that the signalling is upgraded to an appropriate standard that will be compliant with current standards and will have the ability to be compatible with future technologies.

8.2.3.6 Benefit Criterion Six: Carry out other major works that require a possession or blockade

Summarised in the table below are the scores that have been awarded to each option under benefit criterion five:

Option	Description	Score
2a	Do Minimum: Heavy Maintenance	0
3a	Full Renewal with One Loop Only	10
3b	Full Renewal with One Loop Only (without Bridge Works)	0
4a	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena)	10
4b	Full Renewal with Two Loops (including a DDA compliant halt at Bellarena) (without Bridge Works)	0

Options 2a, 3b and 4b score zero as all options will require blockage at a later date in order to address maintenance issues and the issues in relation to the bridges.

Options 3a and 4a score ten reach. Both options involve carrying out all identified works that are required.

8.2.4 Summary of weighting and scoring

following table summarises each options score against the non-monetary criteria. The options are then ranked in the order in which they most satisfy the non-monetary criteria.

The	Weighting	2a		3a		3b		4a		4b	
		Score	WS	Score	WS	Score	WS	Score	WS	Score	WS
1	20	0	0	10	200	8	160	10	200	8	160
2	20	0	0	10	200	8	160	10	200	8	160
3	20	6	120	9	180	7	140	10	200	7	140
4	10	4	40	10	100	10	100	10	100	10	100
5	10	6	60	10	100	10	100	10	100	10	100
6	20	0	0	10	200	0	0	10	200	0	0
Total	**100**	**-**	**220**	**-**	**980**		**660**	**-**	**1000**		**660**
Rank		**5**		**2**		**3**		**1**		**3**	

8.3 Conclusion on Non Monetary Assessment,

Option 2a scores 220 overall under non-monetary assessment as it does not meet all of the project objectives and hence, contributes less towards the non-monetary criteria than the other Options.

From a qualitative viewpoint Option 3a ranks second and Option 4a ranks first.

9 Quantitative Analysis

This section assesses the performance of each option on a quantitative basis. The quantitative analysis was completed using a net present cost (NPC) calculation. A detailed profiling of the expenditure across the project time-span was provided by Translink and used in this calculation.

9.1 Net Present Cost

Each of the options was subjected to a NPC analysis (including Optimism Bias at 20%) over a 30 year period at a discount rate of 3.5% real. The first period, year zero (2009/2010), includes only costs which have already been incurred and therefore are sunk. As a result these costs are not included within the NPC calculation. The table below highlights the capital costs[21] (including optimisim bias) and associated revenue costs. The costs were supplied by Arup and Translink (see Appendix 5 for attached NPC spreadsheets).

Option	Capital Cost (Incl OB) (£)	Annual Revenue Cost Post Implementation (Post yr 12) (£)	Signalling and Maintenance Costs (£)	Additional Capital Required in Year 5/12 (£)	Dis-benefits (£)	NPC (£)
2a	61,735,800	776,468 (473,267)	115,810	49,481,920	341,755	**101,226,083**
3a	75,019,632	473,267	-	-	-	**79,213,483**
3b	72,169,260	473,267	-	5,253,923	-	**80,959,171**
4a	80,271,542	473,267	-	-	-	**84,147,743**
4b	77,292,352	473,267	-	5,245,181	-	**85,893,433**

The results of the NPC analysis indicate that Option 3a would represent the best option in terms of cost with an NPC of **£79,213,483**.

9.2 Sensitivity Analysis

No sensitivity analysis has been carried out as the capital costs have been adjusted for optimism bias and there are no associated revenue costs.

9.3 Summary

Set out below is a summary of the net present costs for each option:

Option	NPC (£)	Ranking
Option 2a	**101,226,083**	5
Option 3a	**79,213,483**	2
Option 3b	**80,959,171**	1
Option 4a	**84,147,743**	4
Option 4b	**85,893,433**	3

The results of the NPC analysis indicate that Option 3a would represent the best option in terms of cost with an NPC of **£79,213,483**.

[21] These costs, as stated within Section 6, have been rebased to 2011

10 Financing, management, monitoring and evaluation

10.1 Financing

The proposed project will be funded by Translink and the Optimism Bias adjusted capital costs of each of the options under consideration are summarised in the table below.

Category	Option 2a	Option 3a	Option 3b	Option 4a	Option 4b
Capital Expenditure (excluding sunk costs)	85,224,306	62,412,339	64,411,966	66,781,649	68,781,276
Optimism Bias (30.5% / 20.2%)	25,993,413	12,607,293	13,011,217	13,489,893	13,893,818
Optimism Bias Adjusted Capital Cost (£)	**111,217,719**	**75,019,632**	**77,423,183**	**80,271,542**	**82,675,094**

10.2 Management

10.2.1 Management structure

Translink will establish a management team to manage the implementation of the project with well defined roles and responsibilities and clear lines of communication. The following outlines the proposed management structure for the Coleraine to Derry Track Renewals Project:

- The Internal Translink Project Manager will be Ruairi Savage;
- The External Project Manager will be Chris Caves from ARUP;
- The project will follow Translink's Construction Division Project Management procedures and Office of Government and Commerce Gateway Reviews which implement the process of gateway reviews throughout the duration of the project;
- The Programme SRO will be Clive Bradberry (Infrastructure Executive);
- The Project Sponsor will be Eugene O'Brien (Head of Permanent Way);
- The overall project control manager will be Brendan Harkin; and
- The Internal Translink Project Board consists of Clive Bradberry (Chair), Eugene O'Brien, Mark Aktinson, Jim Moore (Head of Signalling and Telecoms), a DRD representative, Mal McGreevy (General Manager of Railways), Brendan Harkin. The Project Board meet monthly.

10.3 Monitoring and post project evaluation

10.3.1 Monthly assessment

The project will be monitored in the monthly monitoring meetings held at both project and programme level which include meetings at which DRD are represented.

10.3.2 Post-project evaluation

An external consultant will be appointed to carry out a Post Project Evaluation (PPE) one year after completion of the project.

The evaluation will include a comparison of actual capital expenditure against projected capital expenditure and will investigate variances thereon. The project team will be assessed on their effectiveness and economy of the management as well as on total capital expenditure. The evaluation will also consider the variances between projected and actual operation costs during the period and provide explanations. The evaluation will consider how effective the completed project was in achieving its key and measurable objectives and the effect these results will imply for future management and policy decisions. In general the measures should, as a minimum, provide information allowing comparisons of:

- Initial optimism bias projected capital expenditure with the actual outturn for the project. Any significant variances will subsequently be investigated; and
- Assess the extent to which the project has met the original objectives and the identified non-monetary criteria.

11 Selection of preferred option and summary and conclusions

11.1 Preferred Option

The table below illustrates the monetary and non monetary assessment of each of the options under appraisal.

Option	OB Adjusted Capital Cost (£) (including sunk costs)	Net Present Cost (£)	Quantitative Ranking	NMS	Qualitative Ranking
2a	111,217,720	**101,226,083**	5	220	5
3a	75,019,632	**79,213,483**	1	980	2
3b	77,423,183	**80,959,171**	2	660	4
4a	80,271,542	**84,147,743**	3	1,000	1
4b	82,675,094	**85,893,433**	4	660	3

Option 2a has the highest NPC and the lowest Non-monetary score. It should also be noted that in section 6.10 this option had economic dis-benefits associated with it amounting to £341,755.

Option 4a has the highest non monetary score of 1,000, marginally ahead of Option 3a which has a non monetary score of 980. Option 3a has the lowest monetary cost and is almost £5 million less costly in NPC terms than Option 4a.The marginal non monetary advantage of Option 4a over Option 3a does not justify the additional monetary cost of Option 4a. Option 3a is also less costly than Options 3b and 4b but delivers greater non monetary benefit.

On this basis, it is recommended that Option 3a is the Preferred Option which offers Value for Money and which has the potential to meet the overall project objectives for a lesser cost than Option 4a or 4b.

11.2 Conclusions

It is recommended that Option 3a is funded with an Optimism Bias adjusted capital cost (excluding sunk costs) of **£75,019,632**.

11.3 Preferred Option Budget Statement

The Capital and Revenue budgetary implications of the Preferred Option (Option 3a) are set out below.

	Year 0	Year 1	Year 2	Year 3	Year 4	Total 30 Years
		2011/12	2012/13	2013/14		
	£	£	£	£	£	£
Capital DEL	3,786,960	10,603,488	56,804,399	3,824,784		75,019,632
Resource DEL		473,267	473,267	473,267	473,267	**14,198,023**
Total DEL Requirement	3,786,960	11,076,755	57,277,667	4,298,052	473,267	89,217,654

The above table shows a funding requirement of £75 million Capital DEL[22] over a four year period to 2013/14 and a Resource (Revenue) DEL requirement of £473,267 per annum excluding depreciation.

The Coleraine to Derry track renewals project is specifically identified as a priority project in Translink's Corporate Plan and will be funded by the Department for Regional Development.

[22] Departmental Expenditure Limit (DEL)

Appendix 1: Extract from Feasibility Report

7 Option development

The Booz Allen Hamilton report provided a basis for the feasibility stage of the project.

The Project Manger then instigated an initial round of stakeholder meetings to reinforce the project brief and identify the key requirements of each stakeholder. This culminated in a project workshop.

In addition, a number of issues came forward that affected the outputs from the Booz Allen Hamilton report.

7.1 Project workshop

The initial project workshop was held in May 2009 to provide a forum for each stakeholder to discuss the issues with both other stakeholder and the project team.

The purpose of the workshop was threefold; the reinforcement of previously identified key requirements for each stakeholder; to discuss the key options that will inform the appraisal process and achieve consensus on those that should be taken forward; and highlight key project risks, which were then reviewed in a separate risk workshop format.

Each workshop attendee was asked to prepare a list of top five "must have" objectives for the project and a list of top five "like to have" objectives for the project. In addition, they were asked to identify the five greatest risks for the project relating specifically to their own stakeholder area and five other risks that related to areas outside their own specific area. The risk items were recorded and used to inform the risk management process (See Section 14).

The workshop document, with includes the workshop outputs is included in Appendix F. Where, issues agreed in the workshop have subsequently been amended through the feasibility stage, these are shown as underlined text within the document.

The stakeholder objectives are included in Appendix G.

7.2 Timetable

The workshop highlighted a key change in the assumptions supporting the timetable development and this was mandated by the Operations Department; that for the 2012 timetable onwards trains to/from Derry/Londonderry would cross at Coleraine, not at Bellarena as envisaged in the Booz Allen Hamilton report.

Operations recognised that the service patterns to/from Coleraine and Derry/Londonderry and Portrush vary on a seasonal basis. Crossing services at Coleraine allows a service from Belfast to be diverted to Portrush depending on demand. The complementary onward service to Derry/Londonderry would still able to achieve the correct crossing times between Coleraine and Derry/Londonderry and no alteration to the timetable would be required.

Therefore, the loop to support the 2012 timetable would be required close to Derry/Londonderry, with an additional loop to support the enhanced ½ hourly shuttle service between Coleraine & Derry/Londonderry located at Bellarena.

To support this change, during feasibility stage further timetable modelling was undertaken by Translink, which although based on the work carried out by Booz Allen Hamilton, allowed the project team to review the line speed requirements and loop positions to best optimise both these variables.

The results of the Translink modelling with Opentrack © are included in Appendix H.

7.3 Passing loop locations

The passing loop locations are set by the timetable requirements as outlined above.

The loop locations are shown in Appendix I.

7.3.1 Eglinton Loop

To provide an hourly service between Derry/Londonderry and Coleraine, a passing loop is required in the vicinity of the closed station at Eglinton. This will provide one path per hour in each direction between Coleraine and Derry/Londonderry.

The location identified by the project team and confirmed as suitable by the Opentrack© modelling process is between 87.5MP and 88MP.

Photograph 3 – Location of Eglinton Loop at 87.75MP looking east

Photograph 4 – Location of Eglinton Loop at 87.75MP looking west

This location was chosen for a number of reasons as outlined below: -

- The location fits with the timetable modelling carried out by NIR with the Opentrack© software
- Sufficient land is available to provide an 800m loop at this location without significant earthworks
- The land available for the loop is all within NITHCo ownership
- The proposed site has an existing road connection to the A2 and there is sufficient land available to provide a Park & Ride scheme, although this would require the purchase of additional land adjacent to the railway line.

7.3.2 Bellarena Loop

To provide a half-hourly service between Derry/Londonderry and Coleraine, a passing loop is required in the vicinity of Bellarena Halt.

During feasibility stage, extensive modelling by both Booz Allen Hamilton and NIR confirmed that the optimum loop location for the proposed timetable was in this area. In conjunction with the loop at Eglinton, this would provide two paths per hour in each direction between Coleraine and Derry/Londonderry.

At this stage, rail patronage is not expected to require the provision of the second loop prior to 2020, rather than 2018. Therefore, the second loop is shown as an option within the Economic Appraisal options.

Photograph 5 – Location of Bellarena loop looking east; the new station will be located beyond the level crossing

A key factor highlighted in the Booz Allen Hamilton report was the location of the halt serving the Limavady area, which is presently deemed to be served by the halt at Bellarena.

Therefore, in association with the provision of a passing loop at Bellarena, it has been recognised that a new station would need to be provided to facilitate DDA requirements.

The project scope, if a new loop is provided, has included for the provision of two new platforms, complete with lighting, shelters and signage, as well as the provision of DDA compliant access from the Seacoast Road to each platform. Inter-platform access will be achieved via the level crossing. The proposed loop and new platforms can be

accommodated within the current NITHCO boundaries at this location, negating the need to purchase additional land.

However, if no loop is provided the existing station will be retained until the new loop is provided.

Photograph 6 – Location of Bellarena loop looking west

7.4 Operational advantages of two loops

With the provision of only a single loop at Eglinton to facilitate the initial hourly service, there is no opportunity to provide any additional train paths between Coleraine and Derry/Londonderry above those required for the 2012 standard service i.e. one path per hour in each direction.

The provision of the second loop at Bellarena would provide up to two paths per hour in each direction between Coleraine and Derry/ Londonderry. This would facilitate both permanent way trains and special trains, such as those run by the RPSI until the introduction of the half-hourly service.

7.5 Dynamic versus static passing loops

The Booz Allen Hamilton study looked at the option of providing both dynamic and static type loops.

However, the work carried out in support of the feasibility study identified that the proposed loops would be co-located with the existing station at Bellarena and a proposed park and ride site at Eglinton.

A dynamic loop which allows two trains to pass at speed, would require a higher capital outlay, as the dynamic loop would be approximately 4000m (2.6 miles) long (assumed by BAH) in comparison to 800m for the static loop (determined by timetable requirements, train length and signalling overlaps).

In addition, the co-location of the station stops with the loops would negate the dynamic nature of the loop but can be used to advantage in the static loop option as the station dwell time for passenger boarding / alighting is offset against the time required for the signal interlocking to release the routes during operation.

Therefore, the dynamic loop option has been discounted at this stage.

7.6 Loop configuration

The passing loops on the Larne Line are configured with a fast and a slow loop with only the slow loop signalled for bi-directional running and this has been found to severely limit operational flexibility.

Therefore, the loops between Coleraine and Derry/Londonderry will be configure in a fast entry – slow exit configuration and will be fully signalled for bi-directional running.

A run-round at Derry/Londonderry is required for permanent way maintenance trains and will also facilitate steam excursions. This has been located in the vicinity of the 94.7MP and more detail is included in Sections 8.6 & 9.4 below.

7.7 Speed profiles

In consultation with the Permanent Way Department, Operations modelled both the 2012 and 2018 timetables to identify and confirm the necessary speed profiles to achieve the required sectional times to facilitate the timetable.

The agreed speed profiles are set out below: -

- 40mph Coleraine to Bann Bridge

  The Bann Bridge will be limited to a speed of 40mph following refurbishment. As the distance between the bridge and Coleraine station is limited, there is no advantage in having a speed limit greater than 40mph.

- 70mph Bann Bridge to Castlerock

  The line between the Bann Bridge and Castlerock runs parallel to the Bann Estuary and the track alignment is restricted, limiting the maximum speed on a number of curves to 70mph. Therefore, 70mph has been set at the line speed limit for this section of track.

- 90mph Castlerock to Limavady Junction

  To the west of Castlerock the track alignment is predominantly straight with gentle curvatures, providing an opportunity for running up to the maximum permitted speed on Northern Ireland Railways of 90mph, until Limavady Junction.

- 50mph Limavady Junction

  At the site of the former Limavady Junction station, line speed is limited by the severe curvature of the track at this location. There is also a reverse curve leading on to Broharris Bridge, a way-beam bridge which on straight track would be limited to 80mph.

- 90mph Limavady Junction to Foyle Bridge

  To the west of Limavady Junction the track alignment provides an open alignment with ample opportunities for high speed running up to a maximum of 90mph.

- 70mph Foyle Bridge to Signal No. LY394 (94.75MP)

  Between the Foyle Bridge and the proposed run-round at 94.75MP, the alignment of the line through Rosses Bay and the approach to Derry/Londonderry restricts the track geometry, limiting speed to 70mph.

- 40mph 94.75MP – Derry/Londonderry Waterside Station

  The half-mile from the run-round loop at 94.75 to Waterside Station is limited to 40mph.

With these speed profiles, trains will be able to achieve the necessary sectional times between stations to achieve the overall timetable. However, a further review will be undertaken during detailed design to identify any areas where further line speed enhancements can be achieved.

7.8 Limavady Junction curve

The track alignment through the former station at Limavady Junction is on located on a significant curve and the track geometry limits the maximum speed to 50mph.

Photograph 7 – Limavady Junction curve, with abandoned station platform

There are approximately 11 miles to the east and 13 miles to west, where after renewal works, the line speed will be 90mph and as trains would have to slow down to 50mph for this restriction and then accelerate again to 90mph, the project team investigated the option to increase the line speed through this area to 90mph.

The track to the east of the former station is located on embankment which forms part of the local flood defences in the vicinity of the Burnfoot River, which the railway crosses on Broharris Bridge immediately to the west of the former station.

A review of the requirements to increase line speed highlighted that significant civil engineering works would be required, including the construction of a new embankment and a bridge across the Burnfoot River, the capital cost of which could easily exceed three million pounds. In addition, the time saving achieved would only be in the region of 40 seconds, an advantage that could easily be negated by a delay at CODA or by other operational issues.

The expected high cost for the works, coupled with a minimal timetable impact led the project team to conclude that the works provided an extremely poor cost benefit ratio and this option has been omitted from the feasibility stage.

Appendix 2: Breakdown of Bridge Costs

Coleraine / Derry Cost Plan (For Economic Appraisal)
Standalone Bridge Option

Costs (Q3 2011 as main breakdown)

Bridges		£	1,684,466
S&T	8.0%	£	134,757
P-Way	12.0%	£	202,136
Sub-total		**£**	**2,021,359**
Preliminaries - Civils works	15.0%	£	303,204
Method Related Charges	2.0%	£	40,427
Testing & Commissioning	2.0%	£	40,427
Spares	0.5%	£	10,107
Unmeasured Items	2.0%	£	40,427
Sub-total		£	2,455,951
Contractor's Fee	10.0%	£	245,595
Sub-total		£	2,701,547
Design Consultant		inc. below	
Other Consultants - PM / CM		inc. below	
Preparation @	9.0%	£	243,139
Supervision @	5.0%	£	135,077
Provision of temporary bus service (3 months)		£	231,589
Sub-total		**£**	**3,311,352**
Risk @ P50	10.0%	**£**	**331,135**
Sub-total		**£**	**3,642,487**
Optimism Bias	20.0%	**£**	**728,497**
TOTAL (At Q3 2011)		**£**	**4,370,984**

Cost at 2018 i.e. 5 years after opening (Assume inflation = 3%)	**£**	**5,375,760**

Appendix 3: Economic Dis-benefits

Additional time Cost (for Heavy Maintenance Option)

Mode of Transport	Additional Average no. Of Passenger p.a. gained as a result of not implementing full renewal	Minutes saved	Cost per minute (deflation rate of 3.23% applied to convert to 2010 value)	Total
Rail (30% reamain)	51,990	9	0.52595685	**246,101**
Move to Bus (60% of the 70% that leave rail)	72,786	9	0.52595685	**(344,541)**
Move to cars and other (40% of the 70% that leave rail)	48,524	9	0.52595685	**(229,694)**
Total	**173,300**			**(328,134)**

Calculation of Additonal Passenger numbers expected under the Heavy Maintenance Option

Projected Annual Usage of the Derry Line (2009/10 – 2034/35)		From PM Info of Similar Project (Projected Passenger Numbers)			
Year	Projected Annual Usage	Heavy Maintenance Option	Do Something Option	% Difference	% Difference Applied to Our projeted Annual Usage
2009/2010	1,428,378	1,203,000	1,203,000	0%	0
2010/2011	1,452,661	1,251,000	1,251,000	0%	0
2011/2012	1,491,882	1,301,000	1,301,000	0%	0
2012/2013	1,515,753	1,288,000	1,301,000	1%	15,146
2013/2014	1,530,910	1,301,000	1,353,000	4%	58,838
2014/2015	1,546,219	1,314,000	1,408,000	7%	103,228
2015/2016	1,561,681	1,301,000	1,429,000	9%	139,885
2016/2017	1,577,298	1,314,000	1,450,000	9%	147,940
2017/2018	1,589,917	1,327,000	1,472,000	10%	156,615
2018/2019	1,602,636	1,340,000	1,494,000	10%	165,198
2019/2020	1,615,457	1,353,000	1,516,000	11%	173,694
2020/2021	1,626,765	1,367,000	1,539,000	11%	181,809
2021/2022	1,638,153	1,381,000	1,562,000	12%	189,824
2022/2023	1,649,620	1,394,000	1,586,000	12%	199,702
2023/2024	1,659,517	1,408,000	1,609,000	12%	207,311
2024/2025	1,669,474	1,422,000	1,634,000	13%	216,603
2025/2026	1,681,161	1,437,000	1,658,000	13%	224,087
2026/2027	1,691,248	1,451,000	1,683,000	14%	233,137
2027/2028	1,701,395	1,466,000	1,708,000	14%	241,064
2028/2029	1,708,201	1,480,000	1,734,000	15%	250,221
2029/2030	1,716,742	1,495,000	1,760,000	15%	258,487
2030/2031	1,725,325	1,510,000	1,786,000	15%	266,624
2031/2032	1,732,227	1,510,000	1,786,000	15%	267,690
2032/2033	1,739,156	1,510,000	1,786,000	15%	268,761
2033/2034	1,744,373	1,510,000	1,786,000	15%	269,567
2034/2035	1,749,606	1,510,000	1,786,000	15%	270,376
			Average Passenger Increase		**173,300**

To calculate this the following formula is used: **L = A + Bv + Cv ^2 + Dv ^3**

L	consumption (expressed in litres per kilometre)
v	average speed in kilometres per hour
A, B, C, D	parameters defined for each vehicle type

The part of track concerned is 30 miles (18.75 km), 15.625km of this is rural road, 3.125 is urban road

Average spped for Road Type (v)	km/h	Length of Track (km)
Urban road	20	3.125
Rural Road	80	15.625

Vehicle Operating Costs (for an average car)

Parameters	Road Type	A	Bv	Cv ^2	Dv ^3	L (pence per km)	Pence per journey (L * Length of Track)
		3.358941551	-0.076406459	0.00086576	-2.77689E-06		
v	Urban road (20 km/h)	-	20	400	8000	2.154900897	6.734065302
	Rural Road (80 km/h)	-	80	6400	512000	1.365516571	21.33619643
							28.07026

Expected no of passengers to use cars	Additional Cost (£) (Pence per Journey * Additional Passengers)
48,524	13,621

Appendix 4: Risk Register

COLERAINE TO DERRY RENEWALS PROJECT RISK REGISTER

ARUP

Chandler KBS
COST & PROJECT MANAGEMENT

R	12
A	29
G	21
N/A	0
Total	**62**

Note :- Risk Item Ref 11 amended 29 Oct 09
Risk Items 11,21,42,56 & 62 amended 24 Nov 09
Risk Items 5, 11,21,32,42,56,61 & 62 amended 4 Dec 09

Risk Identification			Risk Prioritisation				Risk Ownership, Mitigation, Etc.	
Risk Item Ref.	Category	Risk Description	Risk Matrix Priority Scores: Probability (1 to 6)	Probability %	Impact (1 to 4)	Risk Matrix Priority Ranking	Risk Owner	Mitigation
11	Cost	Signalling scheme definition changes from feasibility budget	6	100	3	18	Cost Manager	Early revised cost estimate to reflect current signalling proposals (Also 56 & 59)
62	Cost	Estimate proves incorrect in terms of quantity and price due to stage in design development	6	100	3	18	Cost Manager	Include effect (quantity and price) in risk register
8	Cost	Risk of not securing (adequate) funding from DRD / DFP - show stopper	4	55	4	16	Translink PM	Translink / DFP / DRD engaged throughout Stage B
53	Operational	Increased air traffic at Derry Airport leads to increased frequency of delayed train services	5	95	3	15	Translink PM	Check assumptions in timetable model, written agreement between Translink / airport operator, model to reflect realistic delay; check impact of more trains in system
56	Strategic	Differing views / drivers within Translink and other stakeholders contibutes to scope creep	4	45	3	12	Arup PM	Ongoing review of scope against cost, and design against brief, keep down to a core scope that achieves project objectives, prevent creep, ring fence brief, define requirements. Linked to 11
42	Procurement	Poor contract documents compromises project objectives and / or passes increased risk to Translink	3	55	4	12	Arup PM	Linked to 41
32	Interface	Poor interdisciplinary interfaces between stakeholders causes disruption to project. Manage interface at Construction phase between designers to ensure integration / buildability / programme. Lack of integration will lead to disruption.	3	55	4	12	Arup PM	Formalise construction stage relationships incl procurement to minimise number of interfaces. Linked to 41.
21	Design	Incorrect selection of design consultant compromises project objectives	3	55	4	12	Translink PM	Adequate brief, scope, site survey and selection strategy, responsive during construction, advice from external PM. Linked to 41
33	Strategic	Differing views / drivers within operations contibutes to	4	80	3	12	Arup / Translink PMs	Single representative / decision making body from operations,
52	Political / Social	Political support for the project deteriorates / changes emphasis	3	45	4	12	Translink PM	Translink to engage with local representatives and positive PR (impact concurrent with 08)
60	Strategic	Relocation of Derry station causes changed brief, with cost and programme impact	3	45	4	12	Translink Infrastrucure Exec	Translink to reach early agreement with ILEX / DCC. Linked to 11. Board approval required to remove risk required
34	Operational	Assumptions in timetable model prove incorrect and causes	4	55	3	12	Arup / Translink PMs	Feasibility study with options costed
59	Strategic	Requirement to make bridge improvements on Coleraine to Derry line (separate project) impacts renewals scope/ programme	5	95	2	10	Translink Structures Team	Early feedback from structures assessments, prioritise early information on Faughan and Roe Bridge, Stage B will have to make an assumption. Linked to 11
54	Interface	Derry Airport doesn't provide access in line with programme causes delay	5	95	2	10	Translink PM	Agreement between operators prior to tender stage, controlled access
61	Construction	Non-availability of reliable 1600mm gauge plant (tamper) to fit in with programme / cost increases	3	20	3	9	Translink PM	Explore options for supply of tampers from NIR other sources. Linked to 41
5	Construction	Non-availability of reliable 1600mm gauge plant (motive power and ballast wagons) to fit in with programme / cost increases	3	48	3	9	Arup PM	NIR decision required on supply. Linked to 41
26	Design	Inadequate P Way design and specification leads to failure to meet durability requirements and increased cost (if over specified)	3	48	3	9	Arup PM	Selection of designer, site investigation. Linked to 21, 27, 28, 41, 42
3	Construction	Inability to obtain materials supplies (ballast, rail and sleepers) in accordance with programme	3	55	3	9	Arup PM	Early engagement with suppliers, possible client supply to be considered by TA team. Linked to 41
27	Design	Drainage design not compatible with track alignment, bridges, and embankments causes delay to construction stage	3	48	3	9	Arup PM	P Way designer to design P Way drainage. Linked to 18

ARUP

Chandler KBS
COST & PROJECT MANAGEMENT

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Risk Item Ref.	Category	Risk Description	Risk Matrix Priority Scores: Probability (1 to 6)	Probability %	Impact (1 to 4)	Risk Matrix Priority Ranking	Risk Owner	Mitigation
41	Procurement	Inappropriate procurement strategy compromises project objectives	3	48	3	9	Arup PM	Ongoing work on procurement strategy, how to procure signalling to ensure objectives met, nomination of signalling subcontractor (also 5, 40, 43 & 18)
7	Construction	Inadequate client site supervision causes serious delay / disruption to programme	3	50	3	9	Arup PM	Client supervisor as part of design team / external appointment
43	Procurement	Incorrect approach to contractor quality selection pushes costs too high	3	50	3	9	Arup PM	Market briefing, requirement to benefit local economy, links to procurement strategy, linked to 41 and 42
44	Procurement	Insufficient tender duration puts contractors off and / or pushes costs up	3	50	3	9	Arup PM	TA recommended 8 weeks minimum
28	Design	Lack of consideration of existing cuttings, embankments and sea defences leads to cost and programme overun	4	85	2	8	Translink Structures Team	Full scope of works required as part of design, condition survey. Considered as part of P-Way design. Link to 21
29	Environmental	Delays due to environmental issues (flora, fauna, habitats, badgers)	4	55	2	8	Arup PM	Early environmental impact assessment - ongoing
30	Environmental	Environmental constraints due to ASSI, RAMSAR etc	4	55	2	8	Arup PM	Early environmental impact assessment - ongoing. Feedback discussions from NIEA, ensure in contract documents
48	Safety	Over ambitious programme leading to excessive working hours / increased risks	2		4	8	Arup PM	Linked to 1 and 45
35	Operational	Long term loss of passenger base due to construction taking line out of service for significant durations	2		4	8	Arup / Translink PMs	Minimise the duration of closures during constuction stage, optimise programming of closures, communication with general public
36	Operational	End product is not capable of delivering speed profiles required for new timetable improvements	2		4	8	Arup / Translink PMs	Check assumptions in the timetable model with input from signalling and check P-Way geometry / alignment. Linked to 34
37	Operational	Poor temporary service during closure leads to customers making short term alternative transport arrangements	4		2	8	Translink PM / Operations / Marketing	Good alternative services - consider bus / trains in parallel, good PR campaign
45	Safety	Major incidents or accidents involving construction workers causes delay	2	10	4	8	Arup PM	Contractor selection, good design,and early contractor involvement, programming allows for front end planning / preparation
47	Safety	Increased risk of major incident / accidents involving crossing users due to increased line speeds and frequency of trains combined with the number of UWC's	2		4	8	Translink PM	Review UWC risk assessments to establish preventative measures, funding restrictions may compromise. Assumption that provisions for UWCs are funded
20	Design	Non compliance of signalling technology with existing NR standards caused delay to project	2	45	3	6	Translink Signalling Team	Costs required for following traditional methods. Linked to 18
40	Procurement	Signalling tendering documentation doesn't adequately allow the introduction of future proof new technology	2	45	3	6	Translink PM / Signalling Team	Linked to 41
14	Design	Drainage and ducting routes not sufficiently designed or co-ordinated causes disruption / delays in construction	3	52	2	6	Arup PM	Incorporated into civils design, site surveys. Linked to 18
18	Design	Lack of co-ordination between design disciplines during design stage causes delay / additional cost during construction	2	52	3	6	Arup PM	Appoint multi-disciplinary design team. Linked to 41
4	Construction	Neighbours encroach on railway land and cause disruption to construction programme	3	55	2	6	Translink PM	Early engagement with landowners via NITHCO
46	Safety	Disruption caused by the operation and usage of UWC's and level crosssings during the construction phase	6	100	1	6	Arup PM	Build into programming
57	Design	Problems in acquisition of land at Bellarena cause delay / design change	3	55	2	6	Translink PM	Early engagement with landowners via NITHCO. Linked to 4
1	Construction	Unrealistic contract duration causes cost / quality pressures	2		3	6	Arup PM	Expert planning input into programming
49	Safety	Increased risk of incidents / accidents due to closures requiring night time / winter season working	3		2	6	Arup PM	Build into programming

COLERAINE TO DERRY RENEWALS PROJECT RISK REGISTER

ARUP

Chandler KBS
COST & PROJECT MANAGEMENT

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Risk Item Ref.	Category	Risk Description	Risk Matrix Priority Scores: Probability (1 to 6)	Probability %	Impact (1 to 4)	Risk Matrix Priority Ranking	Risk Owner	Mitigation
15	Design	Ballast retention not sufficiently considered leads to delays / additional cost during construction	2	45	2	4		Consider during design stage
55	Procurement	New modular signalling equipment is not available within project timescales leads non optimal design solution	2	45	2	4	Translink Signalling Team	Advise possible impact on project
2	Construction	Access problems with land owners and neighbours causes delay	2	45	2	4	Translink PM	
31	Interface	Cost effectiveness of interfacing with existing signalling assets due to age / condition	2	30	2	4	Translink Signalling Team	Condition and life expectancy survey required
38	Operational	Loss of signalling at Colleraine during closure leads service disruption at Antrim to Portrush	2		2	4	Arup PM / Signalling Team	
58	Strategic	Ban Bridge doesn't secure funding and causes significant disruption and compromises project objectives	3	45	1	3		
39	Operational	Funding constraints leads to Londonderry / Castlerock and Portrush signal cabin not closing	1	5	2	2	Translink PM / Signalling Team	
~~10~~	~~Cost~~	~~Signalling scheme budget exceeds conceptual budget as conceptual budget based on 2002 scheme~~	~~0~~	~~0~~	~~0~~	0	Cost Manager	Revised cost estimate completed, see 11
6	~~Construction~~	~~Work at Coleraine signal cabin and on-going services between Belfast and Coleraine~~	~~0~~	~~0~~	~~0~~	0		
9	~~Cost~~	~~S&T design~~	~~0~~	~~0~~	~~0~~	0		
12	~~Cost~~	~~Setting an accurate and workable project budget~~	~~0~~	~~0~~	~~0~~	0		
13	~~Cost~~	~~Inadequate budget and subsequent scope reduction~~	~~0~~	~~0~~	~~0~~	0		
16	~~Design~~	~~Design and installation of the cable route~~	~~0~~	~~0~~	~~0~~	0		Duplicates 14
17	~~Design~~	~~Signalling design and specification~~	~~0~~	~~0~~	~~0~~	0		Dupliactes 40
19	~~Design~~	~~Scope creep~~	~~0~~	~~0~~	~~0~~	0		
22	~~Design~~	~~Signalling specification, design and installation~~	~~0~~	~~0~~	~~0~~	0		
23	~~Design~~	~~Ducted signal route vesus troughing in certain areas~~	~~0~~	~~0~~	~~0~~	0		
24	~~Design~~	~~Introduction of currently developing new technology and systems~~	~~0~~	~~0~~	~~0~~	0		
25	~~Design~~	~~Scope creep or uncontrolled scope changes due to interference by NIR stakeholders~~	~~0~~	~~0~~	~~0~~	0		
50	~~Safety~~	~~Remote location in the event of an accident~~	~~0~~	~~0~~	~~0~~	0		
51	~~Safety~~	~~Crossing the CoDA flight path~~	~~0~~	~~0~~	~~0~~	0		See risk 54

Appendix 5: NPCs

NPV @ 3.5% p.a.

APPRAISAL DATE Jun-10

OPTION NUMBER & TITLE Option 2a NPC: Do Minimum - Heavy Maintenance

YEAR :	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 27	Year 28	Year 29	Year 30	TOTAL
CAPITAL COSTS (£ 000s): Add Row																															
Option 2a Costs (excluding sunk costs, risk and OB)	2,392,534	6,220,587	36,605,765	2,088,241									37,917,180																	- 15,166,872.00	70057434
OB (at 30.5%)	729,723	1,897,279	11,164,758	636,913									11,564,740																	- 4,625,895.96	21367517
																															0
A. Total Capital Costs (Annual)	3,122,256	8,117,867	47,770,523	2,725,154	-	-	-	-	-	-	-	-	49,481,920	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19,792,768	
B. Total Capital Costs (Cumulative)	3,122,256	11,240,123	59,010,646	61,735,800	61,735,800	61,735,800	61,735,800	61,735,800	61,735,800	61,735,800	61,735,800	61,735,800	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	111,217,720	91,424,952	2722339128
REVENUE COSTS (£ 000s): Add Row																															
																															0
Signalling and Maintenance		50180		65630																											115810
Annual Revenue Cost		776468	776468	776468	776468	776468	776468	776468	776468	776468	776468	776468		473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	473267	17059954
																															0
C. Total Revenue Costs (Annual)	-	826,648	776,468	842,098	776,468	776,468	776,468	776,468	776,468	776,468	776,468	776,468	-	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	
D. Total Revenue Costs (Cumulative)	-	826,648	1,603,116	2,445,214	3,221,682	3,998,150	4,774,618	5,551,086	6,327,554	7,104,022	7,880,490	8,656,958	8,656,958	9,130,225	9,603,492	10,076,759	10,550,026	11,023,293	11,496,560	11,969,827	12,443,094	12,916,361	13,389,628	13,862,895	14,336,162	14,809,429	15,755,963	16,229,230	16,702,497	17,175,764	297,800,389
E. Total Costs (Annual) (=A+C)	3,122,256	8,944,514	48,546,991	3,567,252	776,468	776,468	776,468	776,468	776,468	776,468	776,468	776,468	49,481,920	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	19,319,501	
F. Total Costs (Cumulative) (=B+D)	3,122,256	12,066,771	60,613,761	64,181,013	64,957,481	65,733,949	66,510,417	67,286,885	68,063,353	68,839,821	69,616,289	70,392,757	119,874,677	120,347,944	120,821,211	121,294,478	121,767,745	122,241,012	122,714,279	123,187,546	123,660,813	124,134,080	124,607,347	125,080,614	125,553,881	126,027,148					
BENEFITS (£ 000s):																														-	
																														-	
Economic Dis-benefits																														-	
Additional Time Cost		- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	- 328,134	9,844,020
Additional Vehicle Operating Cost		- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	- 13,621	408,630
G. Total Benefits (Annual)	-	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	- 341,755	10,252,650
H. Total Benefits (Cumulative)	-	- 341,755	- 683,510	- 1,025,265	- 1,367,020	- 1,708,775	- 2,050,530	- 2,392,285	- 2,734,040	- 3,075,795	- 3,417,550	- 3,759,305	- 4,101,060	- 4,442,815	- 4,784,570	- 5,126,325	- 5,468,080	- 5,809,835	- 6,151,590	- 6,493,345	- 6,835,100	- 7,176,855	- 7,518,610	- 7,860,365	- 8,202,120	- 8,543,875	- 9,227,385	- 9,569,140	- 9,910,895	- 10,252,650	
NET UNDISCOUNTED COST* (=E-G)	3,122,256	9,286,269	48,888,746	3,909,007	1,118,223	1,118,223	1,118,223	1,118,223	1,118,223	1,118,223	1,118,223	1,118,223	49,823,675	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	815,022	18,977,746	118,853,365
DISCOUNT FACTOR @ 3.5% p.a.	1.00000	0.96618	0.93351	0.90194	0.87144	0.84197	0.81350	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.63940	0.61778	0.59689	0.57671	0.55720	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.39501	0.38165	0.36875	0.35628	
NET PRESENT COST* (Annual)	3,122,256	8,972,241	45,638,167	3,525,701	974,467	941,514	909,675	878,913	849,191	820,475	792,729	765,922	32,972,476	521,128	503,506	486,479	470,028	454,133	438,776	423,938	409,602	395,751	382,368	369,438	356,945	344,874	321,944	311,057	300,538	- 6,761,361	101,226,083
NET PRESENT COST* (Cumulative)	3,122,256	12,094,497	57,732,664	61,258,365	62,232,832	63,174,345	64,084,021	64,962,934	65,812,125	66,632,600	67,425,329	68,191,251	101,163,727	101,684,856	102,188,362	102,674,841	103,144,869	103,599,002	104,037,778	104,461,716	104,871,319	105,267,070	105,649,438	106,018,875	106,375,820	106,720,694	107,375,850	107,686,906	107,987,444	101,226,083	
TOTAL NET PRESENT COST* =	**101,226,083**																														

* A minus sign in these rows denotes a Net Present Value rather than a Net Present Cost.

NPV @ 3.5% p.a.

APPRAISAL DATE: Jun-10

OPTION NUMBER & TITLE: Option 3a NPC: Full Renewal (Baseline)

YEAR :	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 27	Year 28	Year 29	Year 30	TOTAL
CAPITAL COSTS (£ 000s): Add Row																															
Option 3a Costs (excluding sunk costs, risk and OB)	3,150,549	8,821,537	47,258,236	3,182,017																											62412339
OB (at 20%)	636,411	1,781,951	9,546,164	642,767																											12607293
																															0
A. Total Capital Costs (Annual)	3,786,960	10,603,488	56,804,399	3,824,784	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B. Total Capital Costs (Cumulative)	3,786,960	14,390,448	71,194,847	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	75,019,632	2189921942
REVENUE COSTS (£ 000s): Add Row																															
																															0
Annual Revenue Cost		473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
																															0
C. Total Revenue Costs (Annual)	-	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
D. Total Revenue Costs (Cumulative)	-	473,267	946,535	1,419,802	1,893,070	2,366,337	2,839,605	3,312,872	3,786,139	4,259,407	4,732,674	5,205,942	5,679,209	6,152,477	6,625,744	7,099,011	7,572,279	8,045,546	8,518,814	8,992,081	9,465,349	9,938,616	10,411,883	10,885,151	11,358,418	11,831,686	12,778,220	13,251,488	13,724,755	14,198,023		
E. Total Costs (Annual) (=A+C)	3,786,960	11,076,755	57,277,667	4,298,052	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	89217654
F. Total Costs (Cumulative) (=B+D)	3,786,960	14,863,715	72,141,382	76,439,434	76,912,701	77,385,969	77,859,236	78,332,504	78,805,771	79,279,038	79,752,306	80,225,573	80,698,841	81,172,108	81,645,376	82,118,643	82,591,910	83,065,178	83,538,445	84,011,713	84,484,980	84,958,248	85,431,515	85,904,782	86,378,050	86,851,317	87,797,852	88,271,120	88,744,387	89,217,654	
BENEFITS (£ 000s):																															
																															-
																															-
G. Total Benefits (Annual)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. Total Benefits (Cumulative)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
NET UNDISCOUNTED COST* (=E-G)	3,786,960	11,076,755	57,277,667	4,298,052	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	89,217,654
DISCOUNT FACTOR @ 3.5% p.a.	1.00000	0.96618	0.93351	0.90194	0.87144	0.84197	0.81350	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.63940	0.61778	0.59689	0.57671	0.55720	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.39501	0.38165	0.36875	0.35628	
NET PRESENT COST* (Annual)	3,786,960	10,702,179	53,469,315	3,876,597	412,425	398,478	385,003	371,984	359,405	347,251	335,508	324,162	313,200	302,609	292,376	282,489	272,936	263,706	254,789	246,173	237,848	229,805	222,034	214,525	207,271	200,262	186,946	180,625	174,516	168,615	79,213,483
NET PRESENT COST* (Cumulative)	3,786,960	14,489,139	67,958,454	71,835,050	72,247,476	72,645,954	73,030,957	73,402,941	73,762,346	74,109,597	74,445,105	74,769,268	75,082,468	75,385,077	75,677,453	75,959,942	76,232,878	76,496,585	76,751,374	76,997,546	77,235,394	77,465,199	77,687,233	77,901,758	78,109,029	78,309,291	78,689,727	78,870,351	79,044,868	79,213,483	
TOTAL NET PRESENT COST* =	**79,213,483**																														

* A minus sign in these rows denotes a Net Present Value rather than a Net Present Cost.

NPV @ 3.5% p.a.

APPRAISAL DATE: Jun-10

OPTION NUMBER & TITLE: Option 3b NPC: Full Renewal (Baseline)

YEAR :	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 27	Year 28	Year 29	Year 30	TOTAL
CAPITAL COSTS (£ 000s): Add Row																															
Option 3b Costs (excluding sunk costs, risk and OB)	3,031,975	8,489,528	45,479,617	3,039,862		4,370,984			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64411966
OB (at 20%)	612,459	1,714,885	9,186,883	614,052		882,939																									13011217
																															0
A. Total Capital Costs (Annual)	3,644,434	10,204,413	54,666,500	3,653,914	-	5,253,923	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B. Total Capital Costs (Cumulative)	3,644,434	13,848,846	68,515,346	72,169,260	72,169,260	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	77,423,183	2243349908
REVENUE COSTS (£ 000s): Add Row																															
																															0
Annual Revenue Cost		473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
																															0
C. Total Revenue Costs (Annual)	-	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
D. Total Revenue Costs (Cumulative)	-	473,267	946,535	1,419,802	1,893,070	2,366,337	2,839,605	3,312,872	3,786,139	4,259,407	4,732,674	5,205,942	5,679,209	6,152,477	6,625,744	7,099,011	7,572,279	8,045,546	8,518,814	8,992,081	9,465,349	9,938,616	10,411,883	10,885,151	11,358,418	11,831,686	12,778,220	13,251,488	13,724,755	14,198,023	
E. Total Costs (Annual) (=A+C)	3,644,434	10,677,680	55,139,767	4,127,182	473,267	5,727,190	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	91621206
F. Total Costs (Cumulative) (=B+D)	3,644,434	14,322,114	69,461,881	73,589,063	74,062,330	79,789,520	80,262,788	80,736,055	81,209,323	81,682,590	82,155,857	82,629,125	83,102,392	83,575,660	84,048,927	84,522,195	84,995,462	85,468,729	85,941,997	86,415,264	86,888,532	87,361,799	87,835,066	88,308,334	88,781,601	89,254,869	90,201,404	90,674,671	91,147,938	91,621,206	
BENEFITS (£ 000s):																															
																															-
																															-
G. Total Benefits (Annual)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. Total Benefits (Cumulative)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NET UNDISCOUNTED COST* (=E-G)	3,644,434	10,677,680	55,139,767	4,127,182	473,267	5,727,190	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	91,621,206
DISCOUNT FACTOR @ 3.5% p.a.	1.00000	0.96618	0.93351	0.90194	0.87144	0.84197	0.81350	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.63940	0.61778	0.59689	0.57671	0.55720	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.39501	0.38165	0.36875	0.35628	
NET PRESENT COST* (Annual)	3,644,434	10,316,599	51,473,562	3,722,482	412,425	4,822,140	385,003	371,984	359,405	347,251	335,508	324,162	313,200	302,609	292,376	282,489	272,936	263,706	254,789	246,173	237,848	229,805	222,034	214,525	207,271	200,262	186,946	180,625	174,516	168,615	80,959,171
NET PRESENT COST* (Cumulative)	3,644,434	13,961,033	65,434,595	69,157,077	69,569,502	74,391,643	74,776,646	75,148,630	75,508,035	75,855,286	76,190,794	76,514,956	76,828,157	77,130,766	77,423,142	77,705,631	77,978,567	78,242,273	78,497,062	78,743,235	78,981,083	79,210,888	79,432,921	79,647,447	79,854,718	80,054,979	80,435,415	80,616,040	80,790,556	80,959,171	
TOTAL NET PRESENT COST* =	**80,959,171**																														

* A minus sign in these rows denotes a Net Present Value rather than a Net Present Cost.

NPV @ 3.5% p.a.

APPRAISAL DATE: Jun-10

OPTION NUMBER & TITLE: Option 4a NPC: Full Renewal with Two Loops including a DDA compliant station at Bellarena

YEAR :	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 27	Year 28	Year 29	Year 30	TOTAL
CAPITAL COSTS (£ 000s): Add Row																															
Option 4a Costs (excluding sunk costs, risk and OB)	3,369,026.36	9,433,273.79	50,535,395.32	3,443,953.30																											66781649
OB (at 20%)	680,543	1,905,521	10,208,150	695,679																											13489893
																															0
A. Total Capital Costs (Annual)	4,049,570	11,338,795	60,743,545	4,139,632	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B. Total Capital Costs (Cumulative)	4,049,570	15,388,365	76,131,910	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	80,271,542	2343173015
REVENUE COSTS (£ 000s): Add Row																															
																															0
Annual Revenue Cost		473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
																															0
C. Total Revenue Costs (Annual)	-	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
D. Total Revenue Costs (Cumulative)	-	473,267	946,535	1,419,802	1,893,070	2,366,337	2,839,605	3,312,872	3,786,139	4,259,407	4,732,674	5,205,942	5,679,209	6,152,477	6,625,744	7,099,011	7,572,279	8,045,546	8,518,814	8,992,081	9,465,349	9,938,616	10,411,883	10,885,151	11,358,418	11,831,686	12,778,220	13,251,488	13,724,755	14,198,023	
E. Total Costs (Annual) (=A+C)	4,049,570	11,812,063	61,216,813	4,612,899	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	94469565
F. Total Costs (Cumulative) (=B+D)	4,049,570	15,861,632	77,078,445	81,691,344	82,164,612	82,637,879	83,111,146	83,584,414	84,057,681	84,530,949	85,004,216	85,477,483	85,950,751	86,424,018	86,897,286	87,370,553	87,843,821	88,317,088	88,790,355	89,263,623	89,736,890	90,210,158	90,683,425	91,156,693	91,629,960	92,103,227	93,049,762	93,523,030	93,996,297	94,469,565	
BENEFITS (£ 000s):																															
																															-
																															-
G. Total Benefits (Annual)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. Total Benefits (Cumulative)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NET UNDISCOUNTED COST* (=E-G)	4,049,570	11,812,063	61,216,813	4,612,899	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	94,469,565
DISCOUNT FACTOR @ 3.5% p.a.	1.00000	0.96618	0.93351	0.90194	0.87144	0.84197	0.81350	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.63940	0.61778	0.59689	0.57671	0.55720	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.39501	0.38165	0.36875	0.35628	
NET PRESENT COST* (Annual)	4,049,570	11,412,621	57,146,550	4,160,571	412,425	398,478	385,003	371,984	359,405	347,251	335,508	324,162	313,200	302,609	292,376	282,489	272,936	263,706	254,789	246,173	237,848	229,805	222,034	214,525	207,271	200,262	186,946	180,625	174,516	168,615	84,147,743
NET PRESENT COST* (Cumulative)	4,049,570	15,462,190	72,608,740	76,769,311	77,181,736	77,580,215	77,965,218	78,337,202	78,696,607	79,043,858	79,379,366	79,703,528	80,016,729	80,319,338	80,611,714	80,894,203	81,167,139	81,430,845	81,685,634	81,931,807	82,169,655	82,399,460	82,621,494	82,836,019	83,043,290	83,243,551	83,623,987	83,804,612	83,979,128	84,147,743	
TOTAL NET PRESENT COST* =	**84,147,743**																														

* A minus sign in these rows denotes a Net Present Value rather than a Net Present Cost.

NPV @ 3.5% p.a.

APPRAISAL DATE: Jun-10

OPTION NUMBER & TITLE: Option 4b NPC: Full Renewal with Two Loops including a DDA compliant station at Bellarena

YEAR :	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 27	Year 28	Year 29	Year 30	TOTAL
CAPITAL COSTS (£ 000s): Add Row																															
Option 4b Costs (excluding sunk costs, risk and OB)	3,250,452.51	9,101,265.88	48,756,782.73	3,301,790.88		4,370,984.00																									68781276
OB (at 20%)	656,591	1,838,456	9,848,870	666,962	-	882,939																									13893818
																															0
A. Total Capital Costs (Annual)	3,907,044	10,939,722	58,605,653	3,968,753	-	5,253,923	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B. Total Capital Costs (Cumulative)	3,907,044	14,846,766	73,452,418	77,421,171	77,421,171	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	82,675,094	239660100
REVENUE COSTS (£ 000s): Add Row																															
																															0
Annual Revenue Cost		473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
																															0
C. Total Revenue Costs (Annual)	-	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	14198023
D. Total Revenue Costs (Cumulative)	-	473,267	946,535	1,419,802	1,893,070	2,366,337	2,839,605	3,312,872	3,786,139	4,259,407	4,732,674	5,205,942	5,679,209	6,152,477	6,625,744	7,099,011	7,572,279	8,045,546	8,518,814	8,992,081	9,465,349	9,938,616	10,411,883	10,885,151	11,358,418	11,831,686	12,778,220	13,251,488	13,724,755	14,198,023	
E. Total Costs (Annual) (=A+C)	3,907,044	11,412,989	59,078,920	4,442,020	473,267	5,727,190	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	96873117
F. Total Costs (Cumulative) (=B+D)	3,907,044	15,320,033	74,398,953	78,840,973	79,314,241	85,041,431	85,514,698	85,987,966	86,461,233	86,934,501	87,407,768	87,881,035	88,354,303	88,827,570	89,300,838	89,774,105	90,247,373	90,720,640	91,193,907	91,667,175	92,140,442	92,613,710	93,086,977	93,560,245	94,033,512	94,506,779	95,453,314	95,926,582	96,399,849	96,873,117	
BENEFITS (£ 000s):																															
																															-
																															-
G. Total Benefits (Annual)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. Total Benefits (Cumulative)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NET UNDISCOUNTED COST* (=E-G)	3,907,044	11,412,989	59,078,920	4,442,020	473,267	5,727,190	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	473,267	96,873,117
DISCOUNT FACTOR @ 3.5% p.a.	1.00000	0.96618	0.93351	0.90194	0.87144	0.84197	0.81350	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.63940	0.61778	0.59689	0.57671	0.55720	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.39501	0.38165	0.36875	0.35628	
NET PRESENT COST* (Annual)	3,907,044	11,027,043	55,150,804	4,006,448	412,425	4,822,140	385,003	371,984	359,405	347,251	335,508	324,162	313,200	302,609	292,376	282,489	272,936	263,706	254,789	246,173	237,848	229,805	222,034	214,525	207,271	200,262	186,946	180,625	174,516	168,615	85,893,433
NET PRESENT COST* (Cumulative)	3,907,044	14,934,086	70,084,891	74,091,338	74,503,763	79,325,904	79,710,907	80,082,891	80,442,296	80,789,547	81,125,055	81,449,218	81,762,418	82,065,027	82,357,403	82,639,892	82,912,828	83,176,535	83,431,323	83,677,496	83,915,344	84,145,149	84,367,183	84,581,708	84,788,979	84,989,241	85,369,677	85,550,301	85,724,818	85,893,433	
TOTAL NET PRESENT COST* =	**85,893,433**																														

* A minus sign in these rows denotes a Net Present Value rather than a Net Present Cost.