Edinburgh Tram
Line One, Northern Loop
New Transport Initiative

Craigleith Options Summary

Report No. 203011/58B

November 2003

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Issue and Revision Record

Rev	Date	Originator	Checker	Approver	Description
A	19 Nov 03	AJ Oldfield	DRAFT UNCHECKED	AJ Oldfield	Updated summary report
B	29 Nov 03	J Blewett	S Riddick	G Turner	STAG assessment enhanced

1 Introduction

This report examines three alternative route options which have been developed to negotiate the tram alignment through the Craigleith area.

Option A was identified during previous work carried out in Work Package 1 (WP1) as running along the former Haymarket to Granton railway corridor. However the WP1 report also considered an alternative route over part of this section which ran on street along Groathill Avenue and Telford Road (Option B). The main perceived advantage of this alternative is that it takes the alignment closer to the Western General Hospital. Through further consultation a further option was identified via Crewe Road (Option C) which would provide further improved access to the Western General Hospital and other local business.

Early modelling work undertaken at the Outline Business Case stage was unable to differentiate between Options A and B in terms of likely patronage due to the accuracy of the model. Initial indications are that there is little overall change in patronage between the use of the Former Railway alignment or the Telford Road alignment. The increased runtimes associated with Option C have a detrimental effect on patronage for the loop in the short term and result in operating costs exceeding patronage in the short and long term. Notwithstanding the patronage issue, it is clear through initial consultation that stakeholders believe there is a strong argument for Telford Road and the Crewe Road Options in order to improve accessibility, especially to Western General Hospital

The purpose of this report is to examine the feasibility and relative merits of these three options.

1.1 Assessment of Key Issues

1.1.1 Key Issues

The key issues relating to the Telford Road, Former Railway Corridor and Crewe Road Options have been identified as follows:

- Improved visibility, security and accessibility (especially to Western General Hospital) are provided by the Telford Road and Crewe Road Options.
- A section of shared running with traffic is required on Telford Road and Crewe Road and this, coupled with longer overall routes than the Former Railway Corridor Option, results in longer journey times, more traffic conflict and a requirement for more junction modifications.
- The Telford Road and Crewe Road Options require land take and localised loss of parking and servicing.
- The Telford Road and Crewe Road Options are more expensive due to greater numbers of public utilities and longer route length and cost of associated road works.
- The Crewe Road Option has a greater impact on the adjacent residential environment in terms of potential loss of the amenity planting to the road.

1.1.2 Key Assumptions

Some key assumptions have been made in order to carry out the option assessments:

- Traffic flows will remain at their existing levels and existing traffic movement will be accommodated within the highway cross section where possible.
- Any public utility diversions will take place during the main programme of construction works.
- Capital costs quoted are based on the report date shown. Costs are exclusive of costs associated with depot, vehicles and land property.
- Public Utilities Diversions required for the scheme have been estimated based upon drawings supplied by the Public Utilities companies to date.
- Due to the unavailability to date of traffic model data no detailed assessments and testing of junction performance have been carried out. The following comments are qualitative. However it is the intention that TRANSYT and LINSIG traffic analysis will be carried out on appropriate junctions.
- The runtimes presented in this paper are principally for comparative purposes and may need to be further refined whichever route is taken forward. They do not consider:
  - Sighting issues for line of sight operation
  - Visibility splays and tram stopping sight distance on junction approaches
  - Linespeed constraints imposed by vertical track geometry
  - Linespeed constraints imposed by the contact wire profile
- As no junction analysis was available for this study, runtimes have been calculated assuming that the tram has absolute priority at junctions and is not subject to delay. In reality the tram is unlikely to receive absolute priority at every junction and may have to slow on the approach or come to a halt and wait. It is the intention that operational assessments using the TRANSYT and LINSIG computer programs will be carried out. The runtimes provide a comparison only for factors such as route length and track geometry.
- The assessment of parking and servicing has been undertaken on the basis of existing mapping information and site inspections. No formal frontager survey work has been undertaken or proposed at this stage.
- The opportunity to reassess patronage during Work Package 2 has been limited due to the late availability of the model information. Statements made are primarily qualitative in nature.
- An outline light rail vehicle (LRV) specification for ETL1 has been derived from recent LRV manufacturer data and our experience on similar light rail systems. Whilst no specific vehicle has been selected this outline specification identifies typical operational and performance characteristics required to design the alignment and is purposely drafted to maintain flexibility in vehicle selection at a future stage. The outline LRV specification defines the parameters and performance for the assumed design vehicle – see document 'Issue Note 1 – LRV stats'. The design LRV will ultimately be selected by the Concessionaire in accordance with outline guidance and minimum standards imposed by tie. Therefore, the preceding LRV specification provides flexibility to accommodate a wide range of trams, thus facilitating a competitive and viable market place.

1.2 Route Description

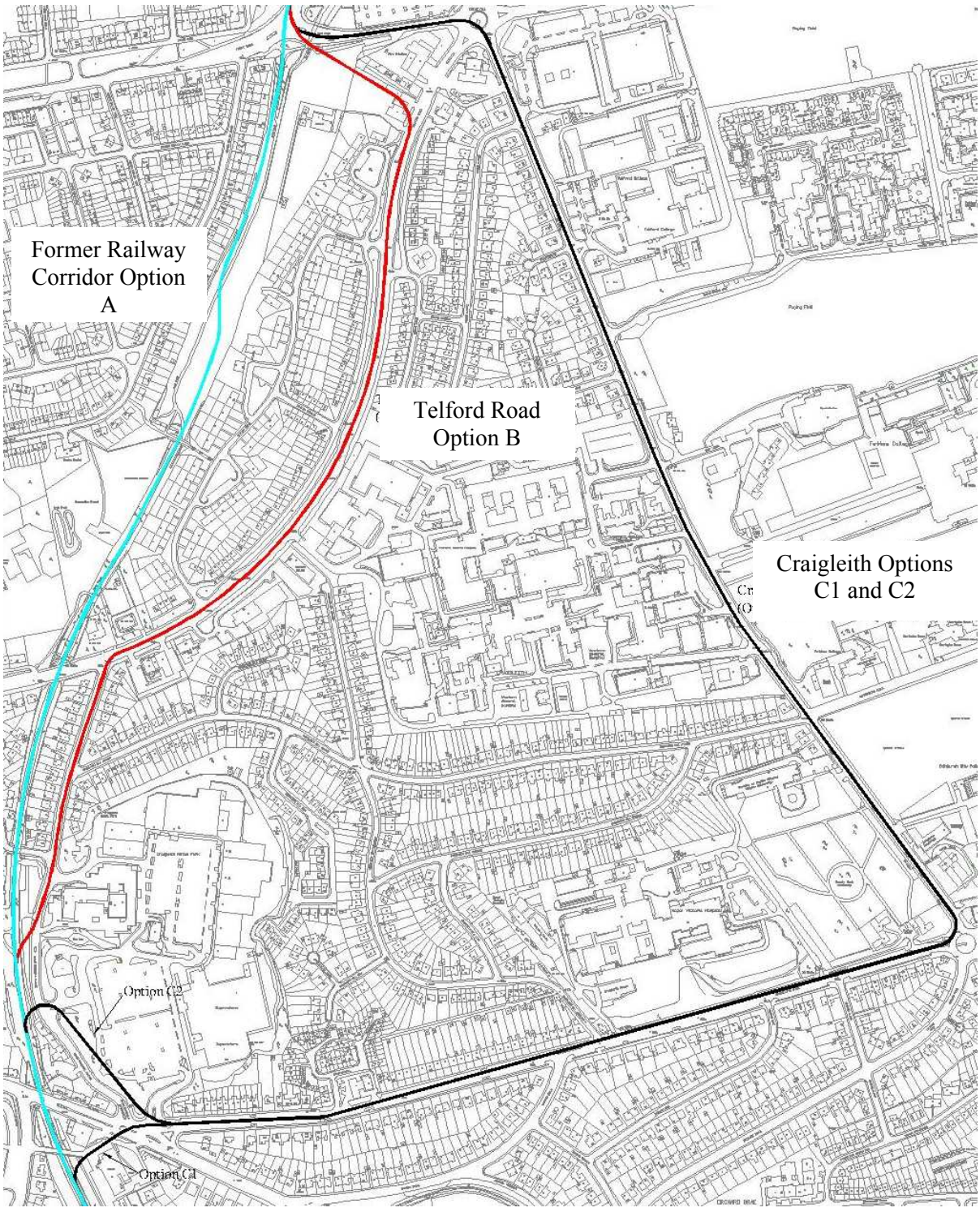

Figure 1: Option Alignments

1.2.1 Option A: Former Railway Corridor

At present the Former Railway Corridor accommodates a combined cycleway/footway. The proposed alignment for the Former Railway Corridor requires the existing footway/cycleway to be relocated to the western side of the tram alignment with the two-way tramway running segregated on the east side. To achieve the width of the tramway and the cycleway/footpath required within the existing railway boundary, in general, the side slopes of the corridor will either have to be made steeper, perhaps by use of a reinforced earth solution, or retained, by use of a more formal structure.

There are three stops provided on this section of the alignment, each 54m long by 3.5m wide:

- Craigleith stop – adjacent to No 11 South Groathill Avenue and providing access to the retail park.
- Western General Hospital – located on the Former Railway Corridor slightly north of Telford Road.
- Crewe Toll stop –Slightly south of the Ferry Road junction.

A formalised crossing point for the footway/cycleway north of the Crewe Toll stop will be required and the Ferry Road and Southern Approach Road signalised junction will be modified to provide tram priority. The underbridge at South Groathill Road also requires to be widened to accommodate the tram.

In terms of OLE, options exist for side poles (both sides) and for either single side or centre poles. The option to provide single side pole arrangements (cantilevering to both tracks) is being considered.

The Former Railway Corridor has been reserved for the Light Rail within the current local plan.

1.2.2 Option B: Telford Road

Telford Road is heavily trafficked and acts as a main distributor road for traffic travelling from Ferry Road to Hillhouse Road / Queensferry Road. The tram has to be integrated with this traffic.

Two sub-options, B1 and B2, are considered for this route:

Option B1

The alignment leaves the Former Railway opposite the play area on South Groathill Avenue and runs on the east side of Groathill Avenue. It then turns east onto Telford Road where it runs in the centre of the street before turning north west through the car park for the Fire Training Centre to rejoin the Former Railway through the junction of Ferry Road and the West Granton Access Road.

The tram would have its own dedicated lanes in the centre of Telford Road with buses and general traffic on the kerb-side lanes.

This option requires some reduction in footway at the Western General Hospital in order to accommodate the stop.

Option B2

The alignment follows the same route as Option B1 above, although on Groathill Avenue it runs on the western side and is kerb running along Telford Road.

Along Telford Road general traffic would run in the centre lanes while the tram and buses share the kerb-side lanes. At these locations care would be needed to avoid obstruction of trams at bus stops.

Kerb running on Groathill Avenue adjacent to houses with garages poses a potential safety hazard with cars reversing out of driveways. Furthermore, more detailed design would be required if this option is taken forward to develop an arrangement which may or may not prove acceptable to HMRI. Such an arrangement may further impact on adjacent properties.

In terms of OLE, centre poles are proposed for centre running and side poles (both sides) proposed for kerb running.

There are a number of technical requirements, common to both of these options. New signalised junctions will be required where the alignment joins Groathill Avenue and between 219 and 225 Telford Road in front of the former petrol station. Existing signalised junctions will be modified at Groathill Road and Telford Road and, in common with the Former Railway Corridor Option, Ferry Road and the West Granton Access Road. The junction of Groathill Avenue and Telford Road would also require re-grading.

Loss of on street parking and servicing will be incurred along one side of Groathill Avenue, however the properties would still have driveway access. There will also be a loss of some formal parking at the Fire Training Centre car park. The existing footpath on east and west side of Groathill Road at the junction with Telford Road will require to be realigned and the access road to Fire Training car park will be relocated to the south of the former petrol station.

Earth retaining structures will be required through the Fire Training Centre car park and the abutment of the footbridge over Ferry Road will require re-engineering.

There are three stops provided on this section of the alignment, each 54m long by 3.5m wide:

- Craigleith stop – adjacent to No. 11 South Groathill Avenue and providing access to the retail park.
- Western General stop – Option B2 requires this to take a staggered central position slightly north of the rear entrance to the Western General Hospital on Telford Road.
- Crewe Toll stop – adjacent to No. 69 Easter Drylaw Drive.

There are greater perceived operational risks relating to Option B2 when compared to Option B1 both in terms of joint running with buses along Telford Road and the tram's potential conflict with vehicles accessing adjacent driveways. Option B2 on Telford Road is therefore preferred and will be further assessed later in this report using the STAG criteria.

1.2.3 Option C: Crewe Road Option

The Crewe Road Option is based upon leaving the Former Railway Corridor in the vicinity of Queensferry Road and running on Craigleith Road and Crewe Road South to rejoin the Former Railway Corridor at Ferry Road.

Craigleith Road is approximately 12.5m wide with parallel parking down both sides. A segregated on street alignment along this stretch may be feasible but it is likely to require the removal of the existing on-street parking and amenity planting. Land take from adjacent properties may also be required and parking restrictions will need to be instigated. (It should be noted that Craigleith Road has high levels

of existing traffic, making the operation of a shared running tramway difficult. This option has therefore not been considered further).

Crewe Road South is not sufficiently wide to accommodate segregated running and the tram would therefore have to share with existing traffic. This is likely to generate significantly longer and unpredictable runtimes.

The alignment described above may be varied to reduce traffic impacts by running off-street on segregated alignment at locations on Crewe Road and Ferry Road. However, this would require additional earthworks and structures with consequent impact upon environment and cost.

There are two potential sub-options, C1 and C2, for the alignment leaving the Former Railway Corridor at the southern extent:

Option C1

This option leaves the main route just south of Queensferry Road and crosses land currently occupied by hotel grounds and the hotel access road. This section of the route would require significant regrading, or earth retaining structures in order to accommodate the tram alignment and it is possible that the hotel itself may be at risk. Further regrading and realignment is also likely to be required as the tram crosses Queensferry Road via a redesigned signalled junction onto Craigleith Road. There would be a significant impact on the operation of this junction as a result.

The alternative to earthworks and regrading would be to adopt a length of tunnelled tramway between the Former Railway Corridor and Craigleith Road. This solution comes with significant cost and disruption.

Option C2

An alternative alignment has also been identified for this section which leaves the main alignment north of Queensferry Road and follows a route through the retail development on the east side of the Former Railway to rejoin the common alignment on Craigleith Road.

Stops may be located north or south of Queensferry Road or in the retail development car park (sub-option C2 only), close to the Western General Hospital on Crewe Road and at Ferry Road.

Due to the significant Engineering difficulties and cost implications of resolving the level difference between the Former Railway Corridor and Queensferry Road, Option C1 has been disregarded at this stage and Option C2 will be assessed further in this report using the STAG criteria.

2 Assessment of scheme impacts

The development of any of these options will generate impacts on the existing environment during implementation and operation. This section of the report highlights the key issues which need to be addressed in order to assess the alignment options presented. Many of the issues raised can successfully be resolved through the consultation process and the following outlines the basis of the discussion.

A qualitative approach to the assessment has been taken which can be further validated at a later stage as required.

Appendix A gives the STAG appraisal tables for the three options carried forward.

2.1 Implementation

(i) Land take and demolition

Land take is required under the Telford Road and Crewe Road Options. The Telford Road Option requires land take from the Western General Hospital, the former petrol station and the fire training centre to accommodate the alignment.

Under the Crewe Road Option, land take is likely to be required from the cemetery at the western corner of Comely Bank roundabout in order to negotiate the tight radius.

In order to provide segregated on-street running on Craigleith Road some land take from adjacent properties is likely to be required in conjunction with the removal of existing parking and amenity planting. Land take will also be required at the retail park.

Demolition is required in the Telford Road and Former Railway Corridor Options. On Telford Road demolition is required at the former petrol station. On the Former Railway Corridor one footbridge requires to be demolished.

Outcome: The Former Railway Corridor is preferred in terms of Land Take and Demolition.

(ii) Construction

The main construction impacts will be associated with disruption to existing routines, noise and potentially, air quality. For example there will be substantially more public utilities to relocate in Telford Road, Craigleith Road and Crewe Road South, increasing disruption to traffic and pedestrians and causing localised increase in noise levels. These effects are temporary and can be mitigated within accepted limits through control measures such as defined working limits and restricted working hours.

Under the Crewe Road Option, works within the retail park may have impacts on parking and servicing and general operations of the local businesses.

Inevitably with street-running sections there will be disruption to normal traffic flows during construction. In particular work at Crewe Toll, Ferry Road, Comely Bank and Queensferry Road junctions may cause significant disruption.

Outcome: The Former Railway Corridor is preferred.

(iii) Cost

Option A: Former Railway Corridor is preferred.

The Preliminary Capital Cost Estimate contains a total cost of £8million (excluding all costs relating to vehicles, land & property, depot and promoters & consultants fees) for the Former Railway Corridor alignment.

The principal cost centres associated with elements of this alignment, are:

- Access arrangements to Stop;
- Clearance and reduction of existing railway solum with potential contamination;
- Works to existing structures (including demolition of the footbridge);
- Realignment of footway/cycleway, and;
- Minimal utilities apparatus.

Option B: Telford Road is preferred.

The equivalent comparative capital cost estimate for the Telford Road Option is £15.9million.

The principal differences, in comparison with the Option A, are:

- Increased route distance;
- Predominantly on-street running requiring highway spec. trackslab construction;
- Significant diversions of utilities apparatus (A provisional allowance of £3.75 million is included for utilities diversions over this section of the route), and;
- Consequential associated highway works.

It should be noted that additional land & property acquisition would be necessary and increased runtime may affect vehicle fleet requirement. These additional costs are not currently included within the estimate provided above.

Option C: Crewe Road

Due to the early stage of the Crewe Road assessment, no formal cost estimate has been made. However using rates on a pro-rata basis for the street running and off-street sections gives an equivalent comparative capital cost estimate of £30.5million.

- For comparison purposes, lengths are taken from the hotel access overbridge to Crewe Toll Stop (at Ferry Road Junction).
- The "best case" Crewe Road Option is assumed as segregated running on Craigleith Road.
- This does not allow for the provision of an additional stop.

Outcome: The Former Railway Corridor is preferred.

2.2 Operation

(i) Highway impacts

The key issue here is the overall lengths of the routes and the degree of segregation from other traffic. The following table summarises the route lengths and degree of segregation:

Option	Total Length (m)	% on street segregated	% on street with traffic	% off street segregated
Former Railway corridor	1480	0	0	100
Telford Road	1670	61.1	23.4	15.5
Crewe Road	2810	38.6	53.2	8.2

For comparison purposes, lengths are taken from the hotel access overbridge to Crewe Toll Stop (at Ferry Road Junction).

The "best case" Crewe Road Option is assumed as segregated running on Craigleith Road.

The on-street alignment on Telford Road and Crewe Road (including Craigleith Road) reduces highway capacity, causing a negative impact on non tram users.

Four new signalised junctions are required for operation of the Telford Road and Crewe Road Options whilst only one is required for the Former Railway Corridor Option. These signals will be designed as far as possible to offer the tram priority over other traffic, although each additional junction inevitably introduces a delay to tram operation which is apparent from the runtimes obtained for the routes.

Less reliable operation is expected under the Telford Road and Crewe Road Options due to mixed traffic on Groathill Avenue and Crewe Road South respectively; and potential delays during, for example, refuse collections may occur and are likely to be unpredictable in nature. Moreover, we would recommend further assessment of the Crewe Road Option is required to satisfy concerns over the ability to ensure that tram priority is achievable.

Outcome: The Former Railway Corridor is preferred.

(ii) Runtime Analysis

Runtime models for the options under consideration have been developed. These are based on a series of links between junctions, stops and other speed constraints such as tight radii and highway speed limits. The runtime models produced for this study have identical underlying assumptions to provide a like for like comparison. Runtimes represent an average outbound tram during a typical peak hour.

The following general assumptions have been made and are consistent with those in previous route evaluation studies:

- A conservative operational acceleration and deceleration rate of 0.9m/s^2 has been adopted, and this is less than the potential 1.2m/s^2 generally achievable by the assumed design LRV and by most trams on the market. Experience on similar light rail systems shows that LRVs generally do not accelerate or brake above 1m/s^2 for passenger comfort reasons and to reflect likely driver behaviour.

- Stop dwell times have been assumed from the likely patronage levels at each of the stops and our experience on similar light rail systems.
- On or alongside the street, the tram would run at a maximum speed of no higher than the existing highway speed limit
- The assumed tram speed takes into account speed restrictions due to horizontal track geometry

The runtimes given in this paper are principally for comparative purposes and may need to be further refined whichever route is taken forward. They do not consider:

- Sighting issues for line of sight operation
- Visibility splays and tram stopping sight distance on junction approaches
- Linespeed constraints imposed by vertical track geometry
- Linespeed constraints imposed by the contact wire profile

No junction analysis was available to this study. Runtimes have been calculated assuming that the tram has absolute priority at junctions and is not subject to delay. In reality the tram is unlikely to receive absolute priority at every junction and may have to slow on the approach or come to a halt and wait. It is the intention that operational assessments using the TRANSYt and LINSIG computer programs will be carried out. The runtimes provide a comparison only for factors such as route length and track geometry.

The following tables provide a breakdown of the runtimes for the two corridors. As stated previously the runtimes do not include for any junction delays so the Telford Road and Crewe Road times are probably underestimated.

Route Option	Runtime
Former Railway Corridor	2m 24s
Telford Road	4m 06s
Crewe Road	5m 20s

For comparison purposes, runtimes are taken from the hotel access overbridge to Crewe Toll Stop (at Ferry Road Junction).

Runtimes for Crewe Road Option calculated on a pro-rata basis based upon segregated running on Craigleith Road and shared running on Crewe Road South. Full segregation is assumed from the Former Railway Corridor to Queensferry Road Junction.

Starting from the central case of 8 trams per hour a run time penalty of 1.7 minutes on Telford Road is such that an additional vehicle in each direction would probably be required unless the additional time can be recovered elsewhere. The fleet size would increase from 14 to 16. Operating costs would increase accordingly from £5.82M to £6.26M p.a.

An additional vehicle would be required in each direction under the Crewe Road option and the operating cost for this option would increase to about £6.4M p.a. due to the increased fleet and route length. The above figures assume free flowing traffic. However, there would be significant interaction with traffic on Crewe Road South which would lead to additional journey time being incurred at certain times, reducing reliability considerably.

There is some flexibility to absorb this unreliability through the layover time provided on the loop, but beyond another 2 to 2.5 minutes, a further two additional vehicles would be needed, increasing the operating cost to about £6.7M p.a.

Due to the completely segregated running along the Former Railway Corridor the consistency of the runtime will be much greater than for the Telford Road or Crewe Road Options. The Former Railway

Corridor Option also provides a higher degree of reliability with respect to delays. Experience with similar LRT systems has highlighted that reliability of service is a major issue with users.

Outcome: The Former Railway Corridor is preferred.

(iii) Patronage

Outline forecasts for the Line 1 alternatives have been produced. These are based on using readily available information from current model forecasts, splitting the impacts into changes in the direct demand arising from the catchment area through which the alternatives pass and the impact on the level of through trips where journey times change.

This early testing has indicated the following patronage figures for Telford Road and the Former Railway Corridor:

	Telford Road	Former Railway Corridor
Patronage (M trips p.a.)	10.32	10.51

Patronage figures for the Telford Road and Former Railway Corridor Options

Patronage does not vary significantly between the two options. The additional run-time for the Telford Road option indicates that an additional tram would be necessary on this route, increasing both capital and operating costs and suggesting that this option may be less economic.

A preliminary assessment of patronage has been carried out for the Crewe Road option. This assessment examines the balance of patronage resulting from the penetration of a larger catchment area and the impact of the longer run time on through patronage. The following table summarises the impacts of the Crewe Road option when compared to the Former Railway Corridor option.

	Trips per annum 2011	Trips per annum 2026
Patronage from additional new catchment area	790 000	990 000
Lost patronage from longer through trips	-1 200 000	-800 000
Net effect on patronage	-420 000	190 000
Change in revenue (£)	-290 000	130 000

Patronage figures and revenue for the Crewe Road Option

The Crewe Road option penetrates a large catchment area which has a positive effect on the catchment patronage. However, the longer run time for the Crewe Road option has a severe impact on the patronage relating to through trips giving an overall loss in patronage of 420 000 trips in 2011. By 2026 the number of through trips recovers to give an overall gain in trips of 190 000.

The gain in trips corresponds to gain in revenue of £130 000 per annum. However, there is an attendant £580 000 per annum. increase in operating costs due to the longer route length and additional vehicles. In addition there are capital costs (for vehicles and route length) which further compound the situation. This alternative is therefore not economically viable

The fully segregated alignment on the Former Railway Corridor facilitates reliable and high running speeds and maximises levels of through patronage. The segregated alignment has no direct impact on highway network operation removing scope for road vehicle – tram conflict. However, local patronage is could be depressed through reduced accessibility to stops and security issues so there is a need to ensure these are addressed in the design.

Outcome: The Former Railway Corridor is preferred.

(iv) Parking and servicing

The assessment of parking and servicing has been undertaken on the basis of existing mapping information and site inspections. No formal frontager survey work has been undertaken or proposed at this stage.

Running on Telford Road represents a loss of on-street parking and servicing on one side of Groathill Avenue although property access will still be maintained. Additional parking will be lost at the fire training centre but the existing bus bays will be maintained to minimise impact on bus operations.

Under the Crewe Road Option, significant impacts would be expected on parking and servicing on Craigleith Road in order to achieve segregated running. On Crewe Road South there is sufficient width to provide formalised parking and servicing arrangements.

If the Telford Road Option or Crewe Road Option are progressed following public consultation, a further consultation and mitigation assessment would be proposed for this aspect.

There are no parking or servicing impacts associated with the Former Railway Corridor Option.

Outcome: The Former Railway Corridor is preferred.

(v) Safety and security

On street (mixed) running on Groathill Avenue or Crewe Road South with additional junctions may marginally increase risk of accidents. The length of shared running is less on Telford Road.

On-street stop locations on Telford Road or Crewe Road will increase visibility and presence of tram stop, with positive impact on personal security and incidence of crime and vandalism. These stops also provide good access to the tram system from adjacent residential areas and the Western General Hospital and convenient passenger transfer between trams and buses.

The isolated and remote stop locations within the Former Railway Corridor may reduce personal security and may increase the potential for incidence of crime and vandalism. Lighting and CCTV requirements in these locations would require further consideration in this area.

Outcome: Telford Road is preferred.

(vi) Operating Cost

The Telford Road and Crewe Road Options provide a longer alignment than the Former Railway Corridor and include a tight radii between Telford Road and the Fire Training Ground and at the Comely Bank Junction respectively. As well as the increase in runtimes, this introduces additional costs relating to tram operation and infrastructure maintenance. For example, there is the possibility of increased long term wear on the tram wheels and the track due to negotiation of the small radius curve and power consumption due to increased acceleration/deceleration on these routes will also be increased.

Outcome: The Former Railway Corridor is preferred.

2.3 Environment

Environmental effects will occur during construction and operation. The following is a general description of the nature of these impacts.

(i) Noise

Daytime ambient noise levels are relatively high on Telford Road and Crewe Road due to high road traffic levels and therefore noise impact from tram operations is unlikely to be significant for roadside properties during the daytime period. There is, however, the potential for wheel squeal to occur at the small radius curves between Telford Road and the Fire Training Ground and at Comely Bank Junction. Conversely there is the potential for noise impacts on properties adjacent to the Former Railway alignment, where present ambient noise levels are low. Noise impacts at both locations may be significant at night. A wide corridor of land is available between Telford Road and Ferry Road and it may be possible to incorporate noise barriers or similar measures into any peripheral corridor landscaping/planting which would provide some noise mitigation for adjacent residential properties.

Outcome: Telford Road is preferred.

(ii) Ecology

The scheme development will result in the permanent loss of small areas of habitat (scrub, woodland and grassland) at the edges of the Former Railway corridor, which is a designated Urban Wildlife Site (UWS). Badgers are a protected species and are known to exist in the corridor, therefore mitigation measures may be required. The vegetation within the corridor is believed to be self seeded and not planted.

Opportunities exist in the area of more open land between Telford Road and the Fire Training Ground for planting of replacement habitat.

The ecological impacts on the Telford Road and Crewe Road Options are minimal.

Outcome: Telford Road or Crewe Road is preferred.

(iii) Geology and soils

Contaminated ground may be present in the Fire Training Ground car park/access area and will almost certainly be present at the site of a former petrol station between the car park and Telford Road through which Option B passes. This latter site is likely to require significant remediation works prior to construction of tram scheme.

The geological impacts on the Former Railway Corridor and Crewe Road Options are minimal.

Outcome: Former Railway Corridor or Crewe Road is preferred.

(iv) Townscape issues

Visual impacts on the rear of properties on Telford Drive, Groathill Avenue and Groathill Road South and on Craigleith Road are possible due to the OLE arrangement on the Former Railway Corridor, Telford Road and Crewe Road alignments.

For the centre running on Telford Road where the tram is segregated, OLE apparatus would be mounted on centre poles keeping it distanced from adjacent properties. However, at Groathill Avenue and particularly Crewe Road South, where the tram operates as shared running with other traffic, space restriction will lead where feasible to either wires being attached to buildings, existing lamp posts etc. or additional side poles. Side pole options increase the visual impact of the system.

Outcome: Former Railway Corridor or Telford Road is preferred.

3 Summary of Key Issues for Route Comparison

All figures are based upon the section of the route from the hotel overbridge to Ferry Road junction (Crewe Toll stop). The figures in this report for the Former Railway Corridor and Telford Road have therefore been adjusted from previous work which studied a longer route length.

Summary of Key Issues for Route Comparison

STAG Objectives	STAG Sub-objective		Former Railway Corridor Option A	Telford Road Corridor Option B	Crewe Road Option – Option C	Best Outcome
Implementability Appraisal	**Technical Feasibility**	**Permanent Landtake**	No land-take required	Land-take required	Land-take required. Significant if segregated running on Craigleith Road is achieved.	**A**
		Highway and Traffic Issues	One junction to be modified. No traffic interaction with tram	Four junctions to be modified Significantly greater traffic effects on the tram	Four Major Junctions Significant effects on tram – further modelling and analysis would be required to confirm feasibility at Crewe Toll. Unpredictable operation due to long length of shared running on Crewe Road.	**A**
		Parking and Servicing Issues	No issues with parking/servicing	Significant impacts on parking/servicing	Impacts on parking and servicing, including possible loss of parking at retail park	**A**
		Structures / Earthworks	Underbridge at South Groathill Road requires to	More structural and earthworks required.	Long length of enhanced track bed	**C**

STAG Objectives	STAG Sub-objective		Former Railway Corridor Option A	Telford Road Corridor Option B	Crewe Road Option – Option C	Best Outcome
			be widened to accommodate the tram	Enhanced track bed required on shared running sections.	required on shared running sections.	
		PU Issues	Minimal PU relocations	Significant PU relocations	Significant PU relocations	**A**
		Route Length	approx. 1480m	approx. 1670m	approx. 3000m	**A**
	Operational Feasibility	**Run Time**	2 m 24s	3m 30s	4m 06s (likely to be significantly increased further due to traffic interface).	**A**
		Operational Issues	Fewer risks operationally	Significantly greater operational issues. Unpredictability on shared running sections. Full priority at junctions unlikely to be achieved.	Significantly greater operational issues. Unpredictability on shared running sections. Full priority at junctions unlikely to be achieved	**A**
Environment	**Noise and Vibration**		Potential noise impacts introduced	Less noise impacts	Less effects than Option A but extended over a longer length than Telford Road.	**B**
	Biodiversity		Possible affects on small areas of habitat although mitigation possible	Less effects than Option A	Less effects than Option A	**B/C**
Economy	**TEE**	**Capital Cost**	£8million	£15.9million	£30.5million	**A**
Safety	**Accidents**		Minimal risk of accidents	Greater risk of accidents	Greatest risk of accidents	**A**

STAG Objectives	STAG Sub-objective		Former Railway Corridor Option A	Telford Road Corridor Option B	Crewe Road Option – Option C	Best Outcome
Safety	**Security**		Isolated stop location could lead to vandalism and crime	Better visibility and security	Better visibility and security	**B/C**
Accessibility	**Base Accessibility**		Less accessible	Good access to the tram system from the adjacent residential area and the Western General Hospital	Good access to the tram system from the adjacent residential area and the Western General Hospital, BAE, Police College and retail park	**C**

4 Recommendation

This report has considered the section of the route which runs from Queensferry Road to Ferry Road and the associated provision of service to local residents in the Craigleith area.

Stag appraises schemes against local planning objectives and wider governmental objectives. The local planning objectives for Edinburgh seek to improve accessibility (to achieve the social inclusion and economic development elements of the transport vision), reduce traffic congestion and pollution and make transport safer.

The preferred route is along the Former Railway corridor. This option has the following advantages:

- Lower capital and operating costs.
- Comparable patronage to the Telford Road option.
- Faster and more reliable runtime.
- Lower land take and demolition of property compared to either of the alternatives.