# TAY ESTUARY RAIL STUDY

## Option Sifting

## Working Paper C

## December 2002

Prepared for:

Tay Estuary Rail Study Steering Group

Prepared by:

Steer Davies Gleave

Babtie Group

# 1. INTRODUCTION

## Context

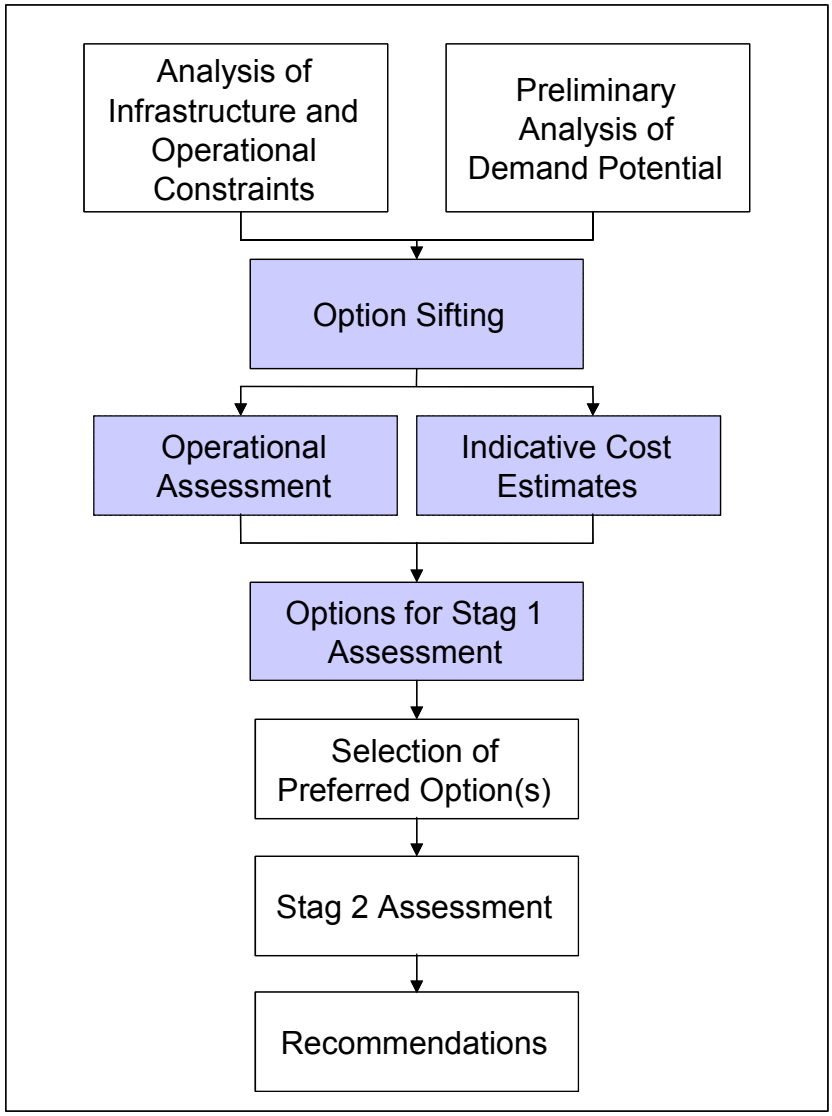
1.1 In this note the building blocks of the process leading to the STAG1 appraisals are summarised. In particular, the option sifting process that feeds into the STAG1 appraisal are highlighted. The options considered in the sifting process under the headings of;

- Service and route options (Chapter 3);
- Station development options (Chapter 4).

1.2 This review process has taken into account the technical (operational and cost) issues arising from the work undertaken by the study team to date in addition to the preliminary analysis of demand potential.

1.3 In Figure 1.1 below the overall appraisal process is set out in flowchart form. This note refers particularly to the tasks identified by shading.

**FIGURE 1.1: PROCESS FLOW-CHART**



## 2. ASSUMPTIONS AND CONSTRAINTS

### Introduction

2.1 Before considering options we set out the position in terms of operational constraints. The focus of the technical analysis in this stage of the study has been on establishing the key constraints to service improvements and developing indicative costs for overcoming these constraints. This Working Paper draws on the analysis presented in Working Paper B[1].

### Timetabling Assumptions

2.2 Any analysis of operations needs to be based around the constraints of a specific timetable. For the purposes of this exercise, the existing timetable has been taken as the basis for the assessment of enhancements, and new local services are assumed to be superimposed on the existing timetable. However, it should be noted that the provision of an enhanced local service presents the opportunity to enable the speeding up of ScotRail inter-regional services creating a two-tier operation of local and faster express services. This stratification of services was looked at by the SSRS and was found to enhance the benefits of the local service. The Rail Passengers Committee is also developing a strategy to speed up inter-regional services within Scotland that follows a similar rationale of separating express from local services.

### Major Infrastructure Constraints

2.3 There are two key infrastructure constraints that have been identified to improving services in the Perth/Ladybank – Dundee – Montrose corridors. These are as follows:

#### *Carnoustie to Arbroath*

2.4 Between Carnoustie and Arbroath, the infrastructure constraint on an hourly and a half-hourly local service is the lack of Intermediate Block Signals (IBS). This signal arrangement gives a 8.5 minute headway which limits the available train paths. It is possible to reduce this sufficiently for the hourly service by the installation (with Network Rail's approval) of rear signal CCTV system feeding to the signal box at Carnoustie along with a passing loop and associated signalling works on the Down line at Carnoustie.

2.5 However, although the provision of CCTV is common elsewhere in the network it is unusual in Scotland and Network Rail Scotland might prefer to install IBS signals controlled from Carnoustie SB or, in the longer term, to move control to Dundee SB.

#### *Arbroath to Montrose*

2.6 The single line from Usan to the River Esk Viaduct south of Montrose is a major constraint, which restricts capacity to at most six train paths per hour. For large parts

[1] Babtie Group, May 2003. Working Paper B: Constraints and Assessment of Options.

of the day and particularly at peak times the railway is operating to capacity it is currently not possible to operate an hourly service or of course, a half-hourly service throughout the day without major civil engineering work to provide dual track over the River Esk Viaduct and associated rock cuttings. The constraint does not necessarily preclude the extension of an irregular service to Montrose in those hours when there is a spare path.

2.7 Further details are set out in Working Paper B.

# 3. OPTION SIFTING

## Approach to Option Sifting

3.1 An option sifting process is recommended in STAG. The aim is to consider all of the options that could theoretically contribute towards the study planning objectives and to shortlist them by identifying and ruling out those options which it is clear would not perform well during a STAG1 appraisal.

3.2 The sifting process has considered a number of possible local service options, including new services over extensions to the network. It should be noted that these are assessed independently of options for improving existing stations and new station proposals at this stage, (the station upgrade options are briefly described in Chapter 4) but that these will be brought together in the STAG1/2 appraisals.

3.3 This section sets out the service options considered in the sifting process and the recommendation as to whether the option should pass into the STAG1 assessment. The recommendations have been informed by the preliminary demand analysis, the operational and timetabling analysis and an assessment of the overall magnitude of cost.

3.4 When considering whether an option should go forward into the STAG1 appraisal we have taken full account of the requirements of the study brief to;

(i) 'operationalise' the proposed framework of the Scottish Strategic Rail Study (SSRS) into a set of *deliverable* rail schemes;

(ii) develop a strategy that provides a suitable basis for *funding* bids from the PTF successor and SRA funding sources.

3.5 Thus there is a strong emphasis on Implementability, as defined within the STAG framework for this study. The SSRS has identified potential funding priorities and the purpose of this study is to identify how they can be implemented. Thus a project which appears to address planning objectives but which is considered by the consultant team to be very unlikely to be implementable on either deliverability or fundability grounds within the timeframe set out by the SSRS would therefore not be taken forward.

### Service Options Considered

#### *Option A: Dundee to Carnoustie*

3.6 For the Dundee to Carnoustie hourly service, there are only minor conflicts in the Up direction. These can be resolved through discussion with Network Rail and Scotrail. The service would cost around £0.75m pa to operate and no infrastructure would be required. However, for the half hourly service there are timetable conflicts throughout the day, which can be partially mitigated but not entirely resolved by the provision of a turn-back loop at Carnoustie.

3.7 Given that there are better options for providing an improved local service than this (see Option B below) we have not recommended this option to go forward.

#### *Option B: Dundee to Arbroath*

3.8 The Dundee to Arbroath hourly service can operate well in the Down direction over the day but in the Up direction, it is necessary to alter the path. Unfortunately, a requirement to loop services at Carnoustie to avoid conflict adds ten minutes to the journey time in the Down direction. The service would cost around £1.5m pa to operate and would require around £0.3m in infrastructure modifications.

3.9 The half-hourly service is conflicted by existing services throughout the day and it is not currently possible to run it at all in the morning and evening peak hours.

3.10 Operating the half hourly service would cost around £3.1 m per annum and require infrastructure works to the tune of £1m.

3.11 Despite the restrictions on peak hour services under the current timetable there is no reason why this service should not be considered in the next stage of the analysis.

#### *Option C: Dundee to Montrose*

3.12 The Dundee to Montrose hourly service is constrained by the infrastructure deficiencies described above to such a degree that it is not possible to operate the service over most of the day. Obviously, the half hourly service is even more constrained. Overcoming these constraints has been costed at over £100m (mainly generated by doubling the single track section at Usan). This significant level of capital investment hits the case extremely hard. Operating costs of an hourly service are estimated at £2.3m pa, and for the half hourly service, £4.7m pa. The demand analysis suggests that a local service between Montrose and Perth would generate in the region of £0.3m pa revenue. A review of the economic case suggests that this is equivalent to only 10% of the usage that would be required to generate a benefit cost ratio of 1.0.

3.13 We do not consider that there is a realistic prospect of achieving a credible economic case for this option (as a regular hourly service) and have not recommended that it be taken forward to the STAG1 appraisal. We have not, however, precluded the consideration of the extension of an irregular service to Montrose (where appropriate) as a variant on the options that are taken forward for more detailed appraisal.

***Option D: Montrose to Brechin***

3.14 The reinstatement of the Brechin line is feasible, but at a cost estimated to be around £18m. Given the cost of enhancing the local service to Montrose (see Option C above) it is not therefore considered feasible to consider the Brechin Branch to be part of the local service. Instead, it can only be considered as a shuttle service. The operating cost of the shuttle is estimated at £0.75m while the revenues are estimated at around £0.25m pa (generated by around 37,500 trips per year). The economic cost benefit ratio is around 0.25, some way short of being an attractive investment, and we see little prospect for this option being fundable as either a standalone scheme, or as part of an extended Dundee-Montrose service (for the reasons noted above).

3.15 It is not recommended for taking forward, but that other options for improving the integration of Brechin with the rail network at Montrose by public transport are considered. The rail based option may remain as a longer term means of achieving these objectives if the Montrose-Usan constraint is removed as part of a wider Inter City strategy (NB it should be noted that the Inter Regional service proposals within the SSRS are not predicated on the removal of this constraint).

**Option E: Perth to Dundee and beyond**

3.16 For the Dundee to Perth service, which can be considered independently or as an extension to the Arbroath services, there are no timetable conflicts that cannot be resolved by discussion with Network Rail. Operated as an extension of the Arbroath-Dundee service, an hourly service would cost £2.3m pa to operate (or £0.8m more than operating only as far west as Dundee).

3.17 This option is recommended for taking forward to the STAG1 appraisal.

***Option F: Perth to Montrose***

3.18 An extension of Option C (Dundee Montrose) to beyond Dundee to Perth would still require the same major infrastructure investment at Usan as indicated above. The service would require three units to operate.

3.19 As with Option C, it is not considered that there is a realistic prospect of achieving a credible economic case for this option (as a regular hourly service) and do not recommend that it be taken forward to the STAG1 appraisal. The option remains, however, for an extension of an irregular service to Montrose (where appropriate) as a variant on the options that are taken forward for more detailed appraisal.

***Options G/H/I/J (Perth/Arbroath) Dundee to Ladybank/Leuchars & St Andrews***

3.20 No major constraints to improving services on the Ladybank to Dundee route exist outside the morning peak period. In this period conflicts in the current timetable make it unlikely that new services can be accommodated running beyond Dundee – however it is possible that terminating services (or those running through with a reversal to Perth) could be implemented.

3.21 Options to serve St Andrews with rail services have been examined as part of this study. Reinstatement of the heavy rail route is estimated to require a capital investment of £34m, some £6m higher than the Scott Wilson estimates in the Fife and South Tayside Rail Study. Given the planning objectives established for this study only a northward looking service from St Andrews has been examined. The scheme that has been tested here, a direct service between St Andrews, Leuchars and Dundee, would contribute particularly towards the achievement of planning objective PO1 – Accessibility (to increase the numbers of people living within a "feasible journey" of certain key destinations).

3.22 However, the preliminary analysis of the financial and economic cost benefit case indicates that the demand estimates (70,000 annual rail journeys generating £0.20m revenue pa) and wider social benefits (valued at £0.25 pa) fall well short of those necessary to make the scheme attractive. With an hourly service to Dundee requiring 1 unit, an annual operating cost of £0.8m has been estimated. Overall, the benefit: cost ratio is less than 0.1.

3.23 Options to serve St Andrews with a Light Rapid Transit (LRT) route have also been examined in outline. A capital cost in the order of £8m per km is estimated, based on the outturn costs of LRT schemes in the UK, and would therefore be even more expensive than the heavy rail option (with a route length of approx 8.5km between Leuchars and St Andrews, this implies capital costs exceeding £60m). LRT operating costs will depend greatly on the organisational arrangements, but at a cost of £3.40/tram kilometre (believed to be consistent with experience on Sheffield, a considerably longer system and therefore likely to represent a lower-end estimate) could imply annual operating costs of £1.4m/annum at a 15-minute headway.

3.24 There would be significant integration issues to address if the LRT service was to run in parallel with heavy rail services between Leuchars and Dundee on the main line, and a shuttle service between Leuchars and St Andrews would suffer from significant diseconomies of scale.

3.25 The poor economics of both the heavy rail and LRT solutions are therefore believed render them infeasible from a fundability perspective (and would therefore fail the Implementability test of STAG if taken forward to the next stage of analysis).

3.26 Non-rail based complementary measures will be considered instead in the STAG1 appraisal as a short to medium term means of implementing a scheme that can meet the planning objectives from the St Andrews area.

3.27 The rail based option may remain as a longer term means of achieving these objectives, but under a more favourable funding climate than can reasonably be envisaged at this point in time.

***Services to Dundee West***

3.28 The timetabling assessment indicates that services could operate to Dundee West or an upgraded Invergowrie station from the east (from either Carnoustie/Arbroath and from Leuchars with a reversal). Pathing constraints, however, indicate that a long layover would be required for services from Arbroath, and that these services could be extended to Perth with no additional train requirement.

### Summary of Option Sifting

3.29 The principal constraining factors determining service development are:

- Options to serve Montrose and Brechin are ruled out due to prohibitive capital costs. Additional local services north of Arbroath require the doubling of the single track at Usan which is estimated at £100m. This significant piece of capital investment hits the case extremely hard. Our analysis suggests that demand would only reach 10% of the usage that would be required to generate a benefit cost ratio of 1.0.
- The case for Brechin is a poor one given the capital costs and the ability to provide only a shuttle service to Montrose (see previous bullet point). The economic cost benefit ratio is around 0.25, some way short of being an attractive investment. Non-rail based complementary measures will be considered instead in the STAG1 appraisal.
- Options to continue west of Dundee favour a Perth terminus rather than one in Dundee West (either Invergowrie or a new Dundee West station) due to major inefficiency in vehicle diagramming and pathing constraints.
- Options to serve St Andrews with rail services suffer from very high capital costs and a poor benefit:cost ratio. The scheme is unlikely to be attractive to either the Scottish Executive or the SRA. Costs for an LRT solution would be even more expensive than the heavy rail option.

3.30 The following table gives a summary of the sifting exercise and highlights the options that will be taken forward for more rigorous testing. Further tables follow which provide more detail on the costs and constraints relating to each of the service options.

**TABLE 3.1 SUMMARY OF SERVICE OPTION SIFTING**

| Option | Constraints | Decision |
|---|---|---|
| Dundee-Carnoustie | Minimal problems in providing hourly service but half-hourly requires new loop but pathing conflicts still potentially a problem. Does not work as a means of enabling the creation of a two-tier service and makes little sense in its own right as operates over too short a distance | Do not pursue, other Crossrail options appear better. |
| Dundee - Arbroath | Requires additional loops and Intermediate Block Section. Pathing constraints create a 10 minute layover in Dundee direction. Major problems in providing half hourly service at peak times. | Retain for STAG1 |
| Options to serve Montrose and Brechin | Capital costs of reinstatement of Montrose-Brechin make for a poor case. To provide a regular hourly service to Montrose or Brechin requires doubling of Usan single section. | Do not pursue, consider alternative means of linking Brechin to the rail network Consider extension of other options on an irregular basis to serve Montrose. |
| Perth - Arbroath | Similar problems east of Dundee but few issues between Dundee and Perth. | Retain for STAG1 |
| Ladybank – Dundee/Arbroath | Need to resolve 19 minute layover in Dundee. Cannot provide peak service within existing timetable constraints. | Retain for STAG1 (but acknowledge peak problems) |

| Option | Constraints | Decision |
|---|---|---|
| St Andrews Branch | Poor economic case makes it highly unlikely to attract funding | Do not pursue, examine bus links in conjunction with enhanced Arbroath/Dundee – Ladybank service |
| Options to serve Dundee West (Invergowrie/new station) | Unit diagramming and pathing constraints result in a 50 minute delay in turning back at Dundee West which suggests that any service option that continues through Dundee should go on to Perth. | Not as terminating service but retain for STAG1 as part of service options through to Perth |

3.31 All sifted options to be retained for STAG1 are to be tested at hourly frequencies and with and without new stations where applicable. In addition certain variants will also be looked at to improve operational efficiency and value for money:

- Shortening the penetration into Fife by terminating at Leuchars rather than Ladybank (whilst Ladybank is the extremity of the study area, Leuchars is a more natural turnback point);
- Linking Fife to Perth rather than Angus;
- Linking Fife to Dundee West.

## 4. STATION DEVELOPMENT OPTIONS UNDER CONSIDERATION

4.1 The following tables detail the potential improvement options for the existing stations in the study area. The proposals are based on the findings of the station audit process and a subsequent review by architectural consultants. They represent a set of recommendations and/or options for each station.

4.2 The responsibility for the funding and delivery of these proposals will vary and has not been considered at this stage. Some of the recommendations will constitute improvements that Network Rail should be undertaking, some will cover upgrades already proposed or committed via PTF bids and the remainder are new proposals that are over and above any existing enhancement proposals.

4.3 A more detailed report of the station options is included in Working Paper B.

**Arbroath**

| Item No. | Proposed Improvement | Estimated Cost | Cost Allocation |
|---|---|---|---|
| | **Total** | **£1,212,500** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 385,000 |
| B | Existing funding applications/in hand | | 295,000 |
| C | TERS – PO3 | | 368,500 |
| D | TERS – PO4 | | 164,000 |

**Balmossie**

| Item No. | Proposed Improvement | Estimated Cost | Cost Allocation |
|---|---|---|---|
| | **Total** | **£2,000,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 0 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 2,000,000 |
| D | TERS – PO4 | | 0 |

| Barry Links | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | Total | **£100,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 100,000 |
| B | Existing funding applications/in hand | | |
| C | TERS – PO3 | | |
| D | TERS – PO4 | | |

| Broughty Ferry | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£915,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 300,000 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 609,000 |
| D | TERS – PO4 | | 6,000 |

| Carnoustie | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£860,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 265,000 |
| B | Existing funding applications/in hand | | 375,000 |
| C | TERS – PO3 | | 204,000 |
| D | TERS – PO4 | | 16,000 |

| Cupar | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£1,511,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 310,000 |
| B | Existing funding applications/in hand | | 240,000 |
| C | TERS – PO3 | | 835,000 |
| D | TERS – PO4 | | 126,000 |

| Dundee | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£2,190,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 560,000 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 1,134,000 |
| D | TERS – PO4 | | 490,000 |

| Golf Street | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | Total | **£2,000,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 0 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 2,000,000 |
| D | TERS – PO4 | | 0 |

| Invergowrie | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | Total | **£1,063,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 290,000 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 745,000 |
| D | TERS – PO4 | | 28,000 |

| Ladybank | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£1,597,500** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 300,000 |
| B | Existing funding applications/in hand | | 90,00 |
| C | TERS – PO3 | | 1,113,500 |
| D | TERS – PO4 | | 94,000 |

| Leuchars | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£363,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 0 |
| B | Existing funding applications/in hand | | 220,000 |
| C | TERS – PO3 | | 47,000 |
| D | TERS – PO4 | | 96,000 |

| Monifieth | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | *Total* | **£718,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 260,000 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 342,000 |
| D | TERS – PO4 | | 116,000 |

| Montrose | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£1,375,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 300,000 |
| B | Existing funding applications/in hand | | 710,000 |
| C | TERS – PO3 | | 343,000 |
| D | TERS – PO4 | | 22,000 |

| Perth | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£7,096,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 4,190,000 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 2,875,000 |
| D | TERS – PO4 | | 31,000 |

| Springfield | | | |
|---|---|---|---|
| **Item No.** | **Proposed Improvement** | **Estimated Cost** | **Cost Allocation** |
| | **Total** | **£1,053,000** | |
| | Station Cost Allocation | | |
| A | Network Rail Backlog Investment | | 350,000 |
| B | Existing funding applications/in hand | | 0 |
| C | TERS – PO3 | | 587,000 |
| D | TERS – PO4 | | 116,000 |

## CONTROL SHEET

| | |
|---|---|
| Project/Proposal Name: | TAY ESTUARY RAIL STUDY |
| Document Title: | Option Sifting |
| Client Contract/Project Number: | |
| SDG Project/Proposal Number: | 204976 |
| Document Number: | See footer |

| | | |
|---|---|---|
| Originator: | Andy Helm | |
| Other Contributors: | Joe Magee (Babtie) | |
| Review By: | Print: | Alan Beswick |
| | Sign: | Approved remotely |

## ISSUE HISTORY

| Issue No. | Date | Details |
|---|---|---|
| 1 | 24.12.02 | Draft to Steering Group |
| 2 | 30.05.03 | Final |
| 3 | 31.07.03 | Revised Final |

## DISTRIBUTION

| | |
|---|---|
| Clients: | Dundee CC & Tay Estuary Steering Group |
| Steer Davies Gleave: | LMM, APH |