

Tavistock Route Re-opening

Option Refinement and Business Case Phase 2

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1 INTRODUCTION

1.1 Background

Jacobs Consultancy has been commissioned by the Kilbride Group to develop and appraise service options for the re-opening of the former railway between Bere Alston and Tavistock. This includes an assessment of the passenger demand for rail travel and the design and development of detailed timetable, resource plan and incremental infrastructure options, together with optimisation of the business case.

Our initial option development and appraisal was reported during May 2008 in the Jacobs Consultancy report: "Tavistock Route Re-opening: Option Specification and Business Case Report". This report was subsequently restructured and expanded in our June 2008 report "Tavistock Route Re-opening: DfT Appraisal Document" to make it compliant to DfT TAG Unit 3.13.1 Guidance on Rail Appraisal.

We examined a full range of service options and identified the optimal cost infrastructure for each service type. These ranged from lower options providing a similar frequency to both Gunnislake and Tavistock to the current Tamar Valley line, to higher frequency options for the route.

Our Phase 1 study provided evidence that potential for a worthwhile case exists, provided the service level and infrastructure specification is focussed at an appropriate level with timings tailored specifically to meet the specific passenger market flow potential. We examined over 20 service and infrastructure options from which we identified a recommended option that exceeded the DfT's benchmark Benefit Cost Ratio (BCR) of 2 for a strong economic case over the full 60 year appraisal period.

The preferred option optimised the Tavistock service, within existing Tamar Valley line infrastructure constraints, at eight round trips with well timed Plymouth peak services and a good range of well-timed leisure opportunities. The Gunnislake service was maintained at seven round trips with a slight retiming of Plymouth peak services (an arrival at 0800 and departures at 1602 and 1816) in order for the Tavistock services to be accommodated. The Tavistock to Plymouth peak service includes a key morning arrival at 0846 and evening departure at 1729. Both of these trains have good connections to and from Exeter and London. Two morning leisure journeys are provided, both offering good connections to Exeter, Bristol and onwards to London via Bristol Parkway. Trains catering for school journeys were closely tailored to the school day.

We considered the key strengths of this service package to be:

- Effective early year start up service to establish market;
- Range of services targeted to particular identified markets;
- Well-timed evening peak Plymouth to Tavistock service;
- Relatively well-timed morning peak Tavistock to Plymouth service;
- Most Tavistock services operate limited stop with competitive journey times compared with road alternatives;
- Well timed Tavistock school services;
- Good connections at Plymouth; and
- Gunnislake route retains the FGW Franchise contractual quantum of service (i.e. seven trains in each direction) to Plymouth.

1.2 Phase 2 Remit

Our remit for this Phase2 work is to update and reappraise the preferred option identified in Phase 1 in the light of timetable and resource changes since 2008 and substantial rail demand growth on the Tamar Valley over the same period. We have also built spreadsheet models to support our rail modelling through public inquiry processes and, through being based on detailed flows, to ensure compatibility with highways impacts appraisal of the scheme.

2 DEMAND FORECASTING

2.1 Establishing Data Availability

We have discussed data availability with First Great Western (FGW), as local train operator who would be well placed to integrate operation of the Tavistock route with their existing Tamar Valley services. FGW has provided us with access to their MOIRA model (2009/10 data) which provides a source of revenue and journeys data by flow as well as being the rail industry standard model for appraising passenger timetable adjustments. FGW have also provided us with detail on ticket sales (notably the Tamar Valley Carnet) which is not captured in the MOIRA model. We met with representatives of FGW on 20th September 2010 to discuss operational aspects of the preferred option, and inputs relating to demand forecasting and operational cost modelling.

Devon and Cornwall Rail Partnership undertake February and August passenger counts for a sample of trains on the Tamar Valley Line. We have obtained the latest February 2010 and August 2010 counts which have enabled us to undertake a 'sense check' of the MOIRA journeys totals and to inform our assumptions on preferred travel times on the Gunnislake route.

Devon County Council (DCC) has shared with us drafts of their West Devon Core Strategy document 'A386 Tavistock-Plymouth Corridor - Transport Analysis and Proposed Rail Scheme'. We have devised our Phase 2 analysis to be in an acceptable form to provide summary inputs to this process, as well as be extensible to more detailed analysis to support later planning decisions relating to the new station and proposed housing. DCC's analysis of traffic on the A386 is used by us to justify a higher level of road decongestion benefit per passenger diverted from road to rail.

As our modelling work will evolve to form an input to the Transport & Works Act process, we have prepared a spreadsheet which bridges the rail industry modelling methods which are used to appraise timetable variants and those which provide a broader appraisal of transport schemes. Inputs are used from the PDFH based MOIRA model to forecast station to station flows on the combined Gunnislake / Tavistock route and to assess (through own mode elasticities) the effect of timetable change. The base flow assumption is, however, derived from trip rate assumptions of catchments for each station which are flexed according to the strength of road based competition. These catchments are built up from ONS Census output areas, and can be accurately mapped onto any highways model zoning which is subsequently developed. This model has been used in the appraisal of our preferred timetable option.

2.2 Demand Forecasting

Passenger demand on the Tamar Valley route exhibits characteristics reflecting the specific markets that it serves. The commuter market (principally to Plymouth) is supplemented by a market for local rural travel, and seasonal tourist travel to a number of stations along the existing route. We would expect the Tavistock extension to share many of these characteristics, with probably a slightly lower Plymouth rail commuter trip rate (due to somewhat better road connectivity to Plymouth), offset to some degree by inwards travel reflecting Tavistock's role as a principal town in the area, including school travel.

We have taken into account the effect of current passengers transferring to Tavistock from other stations on the line. We have also ensured that our estimation of trip rates is sense checked with comparable stations on local branch lines, including terminus stations which can attract railheading from a wider hinterland beyond the immediate catchment area.

2.2.1 Demand Forecasting Spreadsheet

Our method of demand and revenue estimation has been to extract the revenue and journeys for top flows on the existing Gunnislake branch from FGW's MOIRA model (containing 2009/10 data). We supplemented this dataset with a set of 'dummy' flows for Tavistock, assuming that these will be to same major destinations as now for Gunnislake. The base year figures for existing flows were adjusted at a flow level to account for a range of factors (see table below). Additional indices are applied to calculate the Tavistock flow volumes from the base levels with Gunnislake as an origin to account for the different catchment distribution and stronger modal competition of road at Tavistock.

Growth Factor	Assumption
Tamar Valley Carnet	We used the last full year of data on carnet journeys (1001-1013), compared to MOIRA journeys to provide an uplift for carnets.
School Travel	Further journeys have been added to the Bere Ferrers to Tavistock flow to account for school trips. This is based on school pupil numbers advised by Devon County Council.
Other tickets/ product capture	Smaller flows not explicitly modelled in the spreadsheet accounted for as well as ticket products not captured as flows (e.g. tourist passes).
Population adjustment	The relative current catchment sizes of Tavistock and Gunnislake results in an uplift to the Tavistock flows.
Fares effects	We use PDFH elasticities to model demand suppression through fares increases. We have assumed real fares increase at 1% per annum throughout the appraisal period. We have assumed an average Tavistock to Plymouth single fare of £2.63 taking into account all available discounts.
Mode competition effect	The rail trip rate at Tavistock is reduced by 9% relative to that at Gunnislake due to stronger road competition on the Plymouth flow. This is calculated using PDF recommended values on rail cross elasticities to road time change.
Timetable effect	This is calculated in a separate spreadsheet model which creates 6 'rooftop' models for Tavistock flows, Bere Alston flows and Gunnislake/Calstock local flows (up and down) separately. These models assign daily demand to individual trains through assumptions on the profile of preferred departure times and a willingness to deviate from this preference for a given timetable. A 'generalised journey time' is calculated in this spreadsheet and PDFH v5 elasticities are applied to adjust the demand forecast for a changed timetable. Tavistock is assessed as having a superior timetable to that enjoyed by Gunnislake, principally through faster journey time, and is thus assessed as having a 'timetable effect' uplift. The overlaid school

	trips are excluded from this assignment analysis – they are all assumed to use the specific and appropriately timed train.
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We have assessed how journeys are assessed to be changed by the introduction of the new timetable if applied at full fruition levels in the base (2009/10) year, to flows originating or destinating at stations on the route. These station journeys forecasts take account of passengers’ reaction to changes in service provision, and include some reassignment of passengers onto Tavistock services from the existing Tamar Valley route.

In the appraisal we have additionally uplifted the demand at Tavistock to account for the development of 750 homes near the new station proposed by Kilbride. We assume an occupancy of 2.1 persons per household in line with regional averages. This housing is assumed to be introduced at a rate of 75 houses per year for 10 years from 2012. The early year passenger demand assessment identifies approximately 130,000 new passenger trips based on the Option 1f timetable.

2.2.2 Demand Profiles

The demand profiles have been derived from the train counts provided by the Devon and Cornwall Rail Partnership for weekday travel. These have been supplemented by our review of their earlier report ‘The Tamar Valley Line: passenger behaviour attitudes and aspirations: The Devon and Cornwall Rail Partnership, April 2008’ which provided a current picture of usage of the existing train services on the Tamar Valley route.

Both current counts and analysis of the 2008 report indicates that over 60% of rail travel on the Tamar Valley line to Plymouth is in the morning peak and over 45% of the travel from Plymouth on the Tamar Valley line is on the late afternoon train (16:34). This pattern is rather different from the profiles corresponding to ticket types in the MOIRA model – due largely to the exclusion of Tamar Valley Carnet sales from matrices within MOIRA, the tickets shown in MOIRA are mainly associated with off-peak travel. We have hence needed to adjust the demand profiles in our timetable appraisal to align with existing demand.

Given the two-hourly service interval on the Gunnislake route, it has been necessary to apply judgement on the timing of a typical working day, based on the profiles of patronage on a sample of other local routes. We have applied the following profiles for demand on trains to/from Plymouth:

Timeband	Plymouth departures	Gunnislake/Tavistock departures
00:00 to 00:59	0%	0%
01:00 to 01:59	0%	0%
02:00 to 02:59	0%	0%
03:00 to 03:59	0%	0%
04:00 to 04:59	0%	1%
05:00 to 05:59	0%	2%
06:00 to 06:59	1%	3%
07:00 to 07:59	2%	13%
08:00 to 08:59	3%	25%
09:00 to 09:59	5%	13%
10:00 to 10:59	10%	10%
11:00 to 11:59	3%	5%
12:00 to 12:59	2%	2%
13:00 to 13:59	2%	2%
14:00 to 14:59	5%	3%
15:00 to 15:59	10%	10%
16:00 to 16:59	13%	5%
17:00 to 17:59	25%	3%
18:00 to 18:59	13%	2%
19:00 to 19:59	3%	1%
20:00 to 20:59	2%	0%
21:00 to 21:59	1%	0%
22:00 to 22:59	0%	0%
23:00 to 23:59	0%	0%
00:00 to 00:59	0%	0%

2.2.3 Trip Rate Comparisons

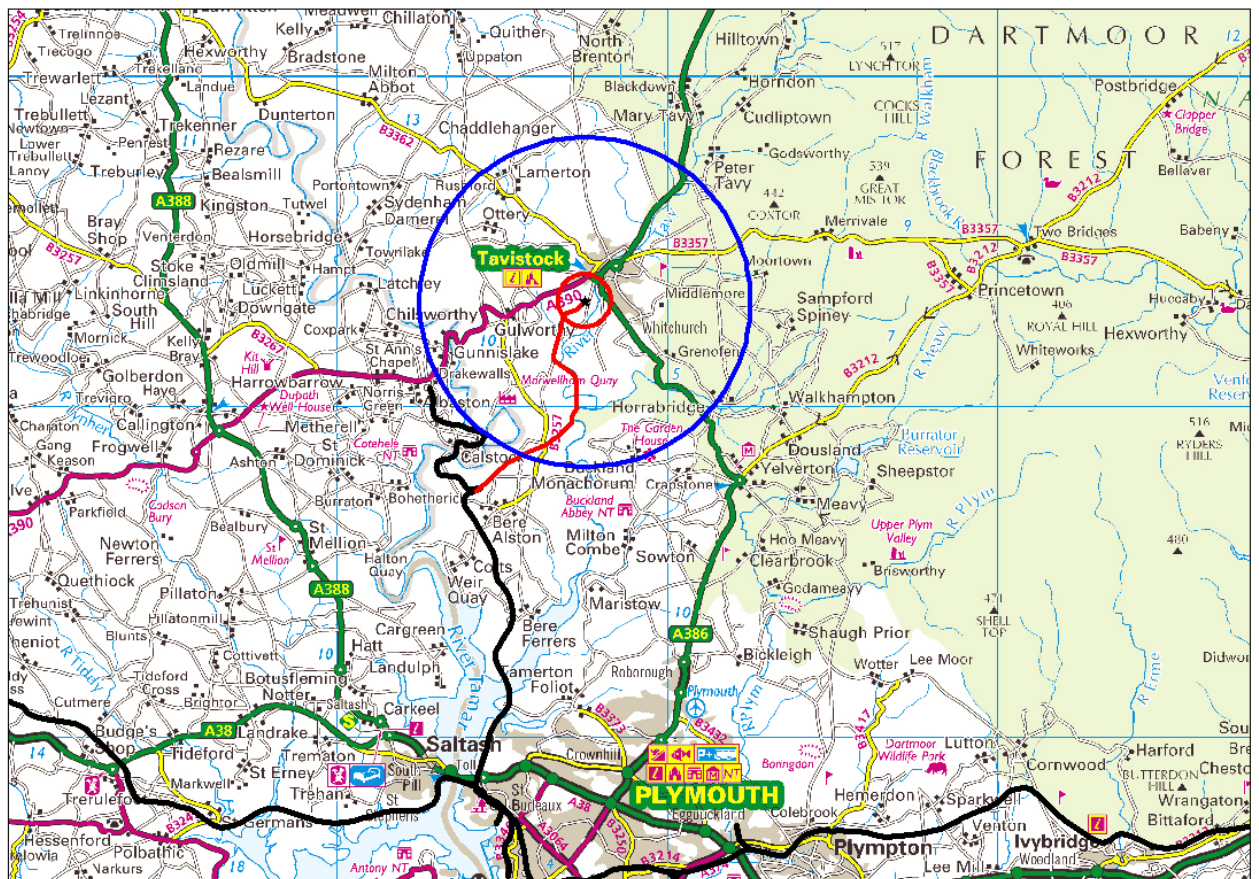
We have also undertaken trip rate analysis as an independent check using volume of flows to Plymouth (2009/10 ticket data) per resident population. Catchment areas are defined as those for which the station is within 5km and where there is no nearer station. Only ¼ of the population beyond 800m is included to reflect the declining trip rate in line with PDFH research. This analysis shows how, when adjusted for standard assumptions on either rail mode strength or road competition, the implied trip rates for Tavistock (at 23 daily trips per 1000 population) fall centrally within those for the stations used for commuting to Plymouth. Our road competition measure is based on the ‘free flow’ car journey times calculated by ‘Transport Direct’ and, given that the rail service quality and mode competition only partly explain the high trip rates from Gunnislake and Calstock, we consider that peak road congestion is likely to be part of the reason too. Tavistock’s rail trip rate would similarly benefit from road congestion between Tavistock and Plymouth as described in DCC’s A386 corridor report.

High outliers include stations which, due to good road accessibility and rail service, attract passengers from a wider catchment area with low outliers including stations from which this demand has been abstracted.

The trip rate for Tavistock is also in line with the PDFH recommended value for a ‘village area surrounding urban centre’ (25 trips per 1000 population) and rather higher than that for a ‘free standing town’ (10 trips per 1000 population).

Station	Annual Journeys	Population catchment	Daily trips per 1000 population	Service frequency	Normalised trip rates to Q=30	Normalised trip rates for car speed =30 mph
Bodmin Parkway	54,978	1,258	65	hourly	44	42
Liskeard	128,506	3,841	49	hourly	34	33
Totnes	112,893	4,740	35	half hourly	19	17
Calstock	22,682	1,168	29	two hourly	23	23
Tavistock (Option 1f)	98,365	5,537	26		26	28
Gunnislake	38,007	2,204	26	two hourly	28	28
St Germans	21,081	1,334	23	hourly	22	22
Bere Alston	22,237	1,774	19	two hourly	16	18
Looe	24,798	3,977	9	hourly	12	12
Ivybridge	34,270	5,814	9	two hourly	10	10
Lostwithiel	11,183	2,343	7	two hourly	6	6
Bere Ferrers	8,110	2,961	4	two hourly	3	3

The following map shows the catchment area assumed for Tavistock with the 800m and 5km areas shown in red and blue respectively:



The service frequency at a station clearly will influence the trip rate at a station and we illustrate below how the Tavistock rate might vary with different service intervals. This calculation is based on the -0.9 elasticity of rail demand with respect to generalised journey time for a flow, given in PDFH v5.

Average service interval (mins)	Tavistock trip rate (based on 28 minutes journey time)
120	24
90	28
60	34
45	38
30	43
15	50

To provide a trip rate comparison with higher frequency services we have analysed trip rates for rail use for local stations into Exeter. Higher frequencies than on the Tamar Valley can often be justified on branches such as the Exmouth branch due to larger population. Several stations (Exmouth and Digby & Sowton) have a similar trip rate to that which is estimated for Tavistock were it to have a ½ hourly service.

Many trip rates are, however, rather lower than for Plymouth commuting over a similar distance, due to better road connections and access at those locations. Overall the top 143 stations ranked by trip rate to Exeter have an average daily trip rate of 19 per 1000 population at an average distance of 17 miles.

Station	Annual Journeys	Population catchment	Daily trips per 1000 population	Distance (miles)	Rail service frequency
Digby & Sowton	129,416	4,360	44	7	half hourly
Exmouth	415,418	14,731	42	13	half hourly
Topsham	100,250	4,200	35	9	half hourly
Umberleigh	8,913	664	20	19	hourly
Totnes	85,738	6,780	19	29	half hourly
Eggesford	9,275	805	17	15	hourly
Torquay	64,822	8,071	12	21	hourly
Exton	9,453	1,627	9	9	hourly
Yeoford	5,319	1,059	7	9	hourly
Crediton	16,407	3,863	6	7	Hourly
Paignton	84,583	23,838	5	21	Hourly
Tiverton Parkway	24,855	9,996	4	22	Hourly
Torre	22,179	18,298	2	20	Hourly

2.3 Location of the New Station and Car Park Requirement

As the section of the former trackbed within Tavistock itself has been redeveloped current proposals suggest that a new station would be built on the existing outskirts of the town to the south west of the town centre. This brings the advantage of available land for car parking enabling the station to have a ‘parkway’ role for a wide rural catchment. Owing to the distance involved, approximately one mile from the town centre, there may be a feeder role for local public transport linking the station with the Tavistock town centre and associated residential areas of the town.

We have examined the likely demand for car parking at Tavistock. Consideration of terminus stations of a similar size at local branch lines indicates that around 30% of passengers access rail by car where the car is parked at or near the station.

At 2009./10 demand levels around 225 passengers are expected to access Tavistock as an originating station on a typical weekday. If we assume a vehicle occupancy of 1.3 and planning at around 80% occupancy to allow for seasonality, there is likely to be demand for around 60 car park spaces initially. To make provision for forecast passenger growth (at 4% per annum in the first 10 years of operation) we recommend a further 50% provision of car park spaces. This indicates that a total car park of 90 spaces would be appropriate on this basis. We have assumed a daily car park charge that would not affect rail demand adversely.

3 TIMETABLE, RESOURCES & OPERATING COSTS

3.1 Base Timetable

Since our previous reports the weekday train service on the Gunnislake branch has been expanded above that committed within the FGW Franchise Agreement from eight to nine round trips Monday to Friday and from seven to eight on Saturdays; with five round trips operating on Sundays. With the exception of the early morning northbound train, all services call at all intermediate stations. The current (May 2010) Monday to Saturday timetable is shown below:

		M-F								
Plymouth		05:06	06:40	08:54	10:46	12:55	14:54	16:37	18:23	21:30
Devonport			06:43	08:57	10:49	12:58	14:57	16:40	18:26	21:33
Dockyard			06:44	08:58	10:50	12:59	14:58	16:41	18:27	21:34
Keyham			06:46	09:00	10:52	13:01	15:00	16:43	18:29	21:36
St Budeaux Victoria Rd		05:12	06:49	09:04	10:56	13:05	15:04	16:47	18:33	21:40
Bere Ferrers			06:58	09:12	11:04	13:13	15:12	16:55	18:41	21:47
Bere Alston	arr	05:25	07:04	09:18	11:10	13:19	15:18	17:01	18:47	21:54
Bere Alston	dep	05:27	07:06	09:20	11:12	13:21	15:20	17:03	18:49	21:56
Calstock		05:33	07:13	09:27	11:19	13:28	15:27	17:10	18:56	22:03
Gunnislake		05:49	07:26	09:40	11:32	13:40	15:40	17:23	19:09	22:16

		M-F								
Gunnislake		05:50	07:31	09:45	11:37	13:45	15:45	17:29	19:14	22:21
Calstock		06:01	07:42	09:56	11:48	13:56	15:56	17:40	19:25	22:32
Bere Alston	arr	06:08	07:49	10:03	11:55	14:03	16:03	17:47	19:32	22:39
Bere Alston	dep	06:10	07:52	10:05	11:57	14:05	16:05	17:49	19:34	22:41
Bere Ferrers		06:16	07:56	10:11	12:03	14:11	16:11	17:55	19:40	22:47
St Budeaux Victoria Rd		06:24	08:05	10:19	12:11	14:19	16:19	18:03	19:48	22:55
Keyham		06:26	08:07	10:21	12:13	14:21	16:21	18:05	19:50	22:57
Dockyard		06:28	08:09	10:23	12:15	14:23	16:23	18:07	19:52	22:59
Devonport		06:31	08:11	10:25	12:17	14:25	16:25	18:09	19:54	23:01
Plymouth		06:35	08:17	10:30	12:22	14:30	16:30	18:14	19:59	23:06

The train marked "M-F" runs only on Mondays to Fridays. Some minor timing variations apply on Saturdays.

The May 2010 Sunday timetable is as follows:

Plymouth		09:09	11:17	13:13	15:17	17:41
Devonport		09:12	11:20	13:16	15:20	17:44
Dockyard		09:14	11:22	13:18	15:22	17:46
Keyham		09:16	11:24	13:20	15:24	17:48
St Budeaux Victoria Rd		09:19	11:27	13:23	15:27	17:51
Bere Ferrers		09:27	11:35	13:31	15:35	17:59
Bere Alston	arr	09:33	11:41	13:37	15:41	18:05
Bere Alston	dep	09:36	11:44	13:40	15:44	18:08
Calstock		09:43	11:51	13:47	15:51	18:15
Gunnislake		09:55	12:03	13:59	16:03	18:27

Gunnislake		10:18	12:07	14:05	16:07	18:39
Calstock		10:30	12:19	14:17	16:19	18:51
Bere Alston	arr	10:36	12:25	14:23	16:25	18:57
Bere Alston	dep	10:38	12:27	14:25	16:27	18:59
Bere Ferrers		10:44	12:33	14:31	16:33	19:05
St Budeaux Victoria Rd		10:52	12:41	14:39	16:41	19:13
Keyham		10:55	12:44	14:42	16:44	19:16
Dockyard		10:57	12:46	14:44	16:46	19:18
Devonport		10:59	12:48	14:46	16:48	19:20
Plymouth		11:03	12:52	14:50	16:52	19:24

Whilst the quantum of trains is the same, there is some variation in timings between summer and winter.

3.2 Timetable Design

In our previous work we explored the trade off between the requirements of market need (and resultant passenger revenue and benefits), resource efficiency (and hence operating cost), and operational deliverability robustness. A series of twenty nested options was initially devised, for which we assessed the costs and benefits (revenue and unpriced benefits) for each. The results demonstrated that option 1f offered the most favourable BCR. This consists of a service for Tavistock of eight round trips with well timed school services, Plymouth peak services and a good range of services providing connections into longer distance main line services at Plymouth and catering for leisure journey opportunities. The Gunnislake service is maintained at the 2008 service level of seven round trips with a slight retiming of Plymouth peak services in order for the Tavistock services to be accommodated. The phase 1 option 1f timetable is shown below:

Phase 1 Study: Option 1f Timetable

Unit Type		153	150		153		150	153	153	153	153		150		153		150	153		153	153	
Cars		1	2		2		2	1	1	1	2		2		2		2	1		1	1	1
Connections arr						08:09			11:15	12:23	13:10	15:06		15:48	16:57	17:21	17:48		18:52	20:25	21:17	
From						Bristol			Padd	Padd	Padd	Padd		ManPicc	Exeter	Padd	ManPicc		Glasgow	Padd	Padd	
Plymouth		05:32	06:22	07:05	07:47	08:28	08:40	10:05	11:20	12:46	13:34	15:20	15:57	16:06	17:06	17:29	18:12	18:16	19:42		20:43	21:44
Devonport			06:25	07:09		08:31	08:43		11:23		13:37		16:00	16:09	17:09		18:15	18:19				21:47
Dockyard			06:27				08:45		11:25		13:39		16:02	16:11	17:11		18:17	18:21				21:49
Keyham			06:29				08:47		11:27		13:41		16:04	16:13	17:13		18:19	18:23				21:51
St Budeaux Ferry Rd													16:06		17:15		18:21					
St Budeaux Victoria Rd		05:38	06:32				08:50		11:30		13:44			16:16				18:26				21:54
Bere Ferrers			06:40				08:58		11:38		13:52			16:23				18:34				22:00
Bere Alston	arr	05:50	06:46		08:05		09:04	10:23	11:44	13:04	14:00	15:38		16:29		17:47		18:40	20:00		21:02	22:08
Bere Alston	dep	05:50	06:48		08:05		09:06	10:23	11:46	13:04	14:02	15:38		16:32		17:47		18:42	20:00		21:02	22:10
Calstock			06:55				09:13		11:54		14:10			16:39				18:49				22:17
Gunnislake			07:07				09:26		12:07		14:23			16:51				19:02				22:29
Tavistock		05:59			08:14			10:32		13:13		15:47				17:56			20:09			21:10

Unit Type		153	150		153		150	153	153	153	153		150		153		150	153		153	153	
Cars		1	2		2		2	1	1	1	2		2		2		2	1		1	1	1
Tavistock		06:03			08:18			10:36		13:17		15:51			18:00			20:13		21:14		
Gunnislake			07:15				09:30		12:11		14:27			16:55				19:07				22:32
Calstock			07:27				09:42		12:23		14:39			17:07				19:19				22:44
Bere Alston	arr	06:12	07:33		08:27		09:48	10:45	12:29	13:26	14:45	16:00		17:14		18:09		19:25	20:22		21:23	22:50
Bere Alston	dep	06:12	07:36		08:27		09:51	10:45	12:32	13:26	14:48	16:00		17:16		18:09		19:28	20:22		21:23	22:53
Bere Ferrers		06:17	07:41				09:56		12:37		14:53			17:21				19:33				22:58
St Budeaux Victoria Rd		06:25	07:50				10:05		12:46		15:02			17:30				19:42				23:07
St Budeaux Ferry Rd			07:57										16:46							20:59		
Keyham		06:27	07:52	07:59			10:07		12:48		15:04		16:47	17:32			19:44		21:01			23:09
Dockyard		06:29	07:54	08:01			10:09		12:50		15:06		16:49	17:34			19:46		21:03			23:11
Devonport		06:31	07:56	08:03			10:11		12:52		15:08		16:52	17:36			19:48		21:05			23:13
Plymouth		06:34	08:00	08:09	08:46		10:15	11:03	12:56	13:44	15:12	16:18	16:55	17:40		18:27		19:52	20:40	21:09	21:41	23:17
Connections dep		06:40			08:55		10:25	11:25	13:25	14:25	15:25	16:25	17:00	17:48		18:43			21:09	To		
To		N/Castle			Padd		Dundee	ManPicc	ManPicc	Edinburgh	ManPicc	York	Padd	W'loo		Exeter			Exeter	Exeter		

In this Phase 2 study we have sought to update option 1f such that it is compatible with the December 2009 timetable on the main line between Plymouth and St Budeaux and with connections further optimised. Following input from Devon County Council we have added additional stops at Bere Ferrers to facilitate the flow of school children to and from schools in Tavistock. It may still be possible to make some minor

amendments to this timetable without reducing the effectiveness of the services, including, for example, an additional stop for the fast Tavistock to Plymouth services. We have also ensured that the updated timetable is able to be robustly delivered through ensuring full compliance with sectional running times, headways, turnrounds and junction margins as specified by Network Rail. We have also compiled full rolling stock and traincrew diagrams to demonstrate compliance with e.g. staff conditions of service. There has been some resultant minor re-timing of services as highlighted below:

Phase 2 Study: Option 1f Timetable

Down																				
Unit Type	153	150		153		150	153	150	153	150	153		150		153		150	153	153	153
Cars	1	2		2		2	1	2	1	2	2		2		2		2	1	1	1
Connections arr	05.13				08.18	08.37		11.17	12.42	13.06	15.06	15.43		16.50	17.23			19.26	20.45	21.50
From	London				Bristol	Bristol		London	Cardiff	London	London	Glasgow		Dundee	London			London	Edinburgh	Edinburgh
Plymouth	05.30	06.20	07.02	07.44	08.19	08.42	10.13	11.30	12.53	13.43	15.17	15.57	16.08	17.06	17.31	18.17	18.22	19.45	20.54	21.56
Devonport		06.23	07.06		08.23	08.45		11.33		13.46		16.00	16.10	17.09		18.20	18.25			21.59
Dockyard		06x24				08x46		11x34		13x47		16x01	16x12	17x10		18x21	18x26			22x00
Keyham		06x26				08x48		11x36		13x49		16x03	16x14	17x12		18x23	18x28			22x02
St Budeaux Ferry Rd												16.06		17.15		18.25				
St Budeaux Victoria Rd		06.30				08.52		11.40		13.53			16.18				18.32			22.06
Bere Ferrers		06.37		07.58		08.59		11.47		14.00			16.25				18.39			22.13
Bere Alston	05.49	06.44		08.04		09.06	10.31	11.54	13.12	14.07	15.36		16.32		17.50		18.46	20.04	21.13	22.20
Bere Alston	05.49	06.46		08.04		09.08	10.32	11.56	13.12	14.09	15.36		16.34		17.50		18.48	20.04	21.13	22.22
Calstock		06.52				09.14		12.02		14.15			16.40				18.54			22.28
Gunnislake		07.06				09.28		12.16		14.29			16.54				19.08			22.41
Tavistock	05.58			08.14			10.41		13.21		15.45				17.59			20.13	21.22	

Up																				
Unit Type	153	150		153		150	153	150	153	150	153		150		153		150	153	153	153
Cars	1	2		2		2	1	2	1	2	2		2		2		2	1	1	1
Tavistock	06.01			08.17			10.44		13.24		15.48				18.02		20.16			21.25
Gunnislake		07.09			09.38		12.18		14.31			16.56			19.10					22.43
Calstock		07.21			09.50		12.30		14.43			17.08			19.21					22.54
Bere Alston	06.10	07.27		08.26		09.56	10.53	12.36	13.33	14.49	15.57		17.14		18.11	19.27	20.25		21.33	23.00
Bere Alston	06.10	07.30		08.26		09.59	10.53	12.39	13.33	14.52	15.57		17.17		18.11	19.30	20.25		21.33	22.03
Bere Ferrers	06.14	07.34			10.03		12.43		14.56	16.02			17.21		19.35					23.08
St Budeaux Victoria Rd	06.23	07.43			10.12		12.52		15.05			17.30			19.43					23.16
St Budeaux Ferry Rd			07.53								16.41		18.12					21q11		
Keyham	06x26	07x45	07x55		10x14		12x54		15x07		16x43	17x32			19x46			21q13		23x18
Dockyard	06x26	07x47	07x57		10x16		12x56		15x09		16x45	17x34			19x48			21q15		23x19
Devonport	06.28	07.49	07.59		10.18		12.58		15.11		16.47	17.36			19.50			22q17		23.21
Plymouth	06.34	07v53	08.05	08.45		10.23	11.12	13.03	13.52	15.16	16.18	16.52	17.41	18.19	18.30	19.55	20.44	21.20	21.53	23.26
Connections dep	06.55		08.07	08.55		10.25	11.25	13.23	14.25	15.23	16.25	16.57	17.48	18.25	18.43			21.25		23.51
To	London		Exeter	London		Glasgow	Dundee	Edinburgh	Edinburgh	Leeds	Leeds	London	Exeter	Birmingham	Exeter			Exeter		London

3.2.1 Infrastructure Requirements

The former railway line from Bere Alston to the proposed new station site on the south west side of Tavistock is approximately 5½ miles in length. No intermediate stations are proposed and taking into account likely linespeeds, gradients and rolling stock a running time of around 9 minutes should be achievable over the new section. The total running time from Plymouth would be around 33 minutes for a train calling at all stations, reduced to 28 minutes calling at only St Budeaux Victoria Rd (for train staff requirements) and Bere Alston.

The basic infrastructure requirement would be to extend the existing single line from the current terminus at Bere Alston over the 5½ miles former double track formation to Tavistock. This basic infrastructure would allow trains to run directly between Plymouth and Tavistock with no other infrastructure changes being necessary. This basic infrastructure allows trains to continue to serve Gunnislake, but owing to the current signalling arrangements and lack of a separate platform at Bere Alston, they would need to continue to operate as a through service to and from Plymouth. A Gunnislake train therefore operates at the expense of a Tavistock path in that hour, and the peak service for the two routes necessarily is a compromise.

3.2.2 Rolling Stock Requirements and Availability

In Phase 1 we considered options over the choice of rolling stock for the services to both Tavistock and Gunnislake and provided recommendations based around suitability for the route, appropriateness for the market and known future availability of that stock type. Options were developed that exploited efficiencies of being operated as part of the regional service by FGW as well as 'stand alone' options which may be explored for a Community Rail Partnership. Our recommendation was for a solution that employs rolling stock already in use in the West franchise area. FGW advise that their strategy envisages the long term use of class 150 and 153 units on the routes west of Plymouth. Whilst class 142/143 "pacer" units have previously been used on the Gunnislake line, the combination of severe curvature and gradients proved them to be unsuitable and they are no longer permitted on this route, particularly on the Bere Alston to Gunnislake section.

Currently the Gunnislake service is operated by a 2-car class 150 unit and our estimated levels of passenger demand will require peak services to be formed of two car train formations on both the Gunnislake and Tavistock routes. We have therefore allocated the existing class 150 unit to the Gunnislake services, leaving additional rolling stock to be allocated for those to Tavistock. Peak Tavistock services will require 2-car trains but in the off-peak, one car is likely to be sufficient. Ideally, therefore, two single car class 153 units are required and these would be operated coupled together in the peaks and singly off-peak. It would be possible to combine class 150 and 153 units to increase the capacity of each train on the Tavistock route if necessary.

We have explored the likely future availability of class 153 units with FGW. They have advised us that two such units are currently employed on the Truro to Falmouth service. Following a doubling of service frequency, this route has seen considerable growth in patronage and there are strong stakeholder aspirations to secure 2-car class 150 units for this route, thereby displacing the class 153s. Whilst we understand that the necessary class 150s have not yet been identified and would not form part of the national fleet re-deployment following the introduction into service of new build trains for the London Midland and London Overground train operators, the delivery of electrification projects elsewhere could result in suitable rolling stock becoming available. For example, in Scotland, electrification works have commenced on the main Edinburgh to Glasgow route and which could lead to some diesel rolling stock becoming available for re-use, probably involving a cascade involving more than one operator.

Compared with the December 2009 timetable on the Gunnislake route, the daily weekday incremental rolling stock mileage for the proposed timetable (revised option 1f) is 192 loaded train miles or 228 loaded vehicle miles. We have been advised by FGW that each class 153 will need to be returned to its home depot in Bristol for maintenance once per week by means of attachment to an existing passenger service. This will add a further 258 empty vehicle miles (129 miles * 2). Full outline rolling stock diagrams are shown in Appendix A.

Further detail on Class 153 stock is attached as Appendix C.

3.2.3 Traincrew Requirements

Traincrew working the Gunnislake line are currently based at Par and Exeter depots where the work is mixed with other routes. Gunnislake work accounts for approximately two full diagrams however. For simplicity, we have assessed the requirements to cover option 1f based on standalone diagrams and a total of four

daily weekday (Mon-Sat) driver and conductor diagrams are required. Therefore a net additional two driver and conductor diagrams are required. When this is translated into actual (establishment) employee numbers required, allowing for additional cover required for rest days, leave, training etc by use of the standard FGW establishment calculator formula, then an additional four drivers and conductors will need to be employed.

3.3 Operating Cost modelling

Costs of train service operation have been calculated using the Jacobs cost model which contains benchmark costs updated from a range of recent industry sources including input data specific to First Great Western (FGW). We have met with FGW to discuss our input unit costings and methodology. Cost categories reported comprise:

- Mileage related costs (fuel, rolling stock light maintenance and variable track access charges);
- Train crew (based on resource requirement incremental on December 2009 diagrams);
- Rolling Stock lease (based on resource requirement incremental on December 2009 diagrams);
- Revenue related costs (miscellaneous costs related to retailing, station staffing and TOC HQ overheads); and
- Long term maintenance and renewal costs, generally contained within Network Rail's Fixed Track Access.

Each option has been assessed using the Jacobs detailed rail service costing model based on our knowledge of the costs of operating rural diesel services. From the detailed option specifications the following input data are calculated:

- Change in vehicles leased by unit type;
- Changes in train crew (driver and conductor) requirement;
- Change in train mileage by unit type; and
- Change in vehicle by unit type.

Long term incremental infrastructure charges are assumed at £100k per annum. This is on the advice of the client and reflects their discussions with DCC, who have taken on responsibility for much of the trackbed and structures from BRB (residuary).

We assume implementation during 2013/4 with full costs incurred in that financial year and thereafter. Although there will be a lag between route and station works and full service implementation FGW will incur setup costs, including driver and conductor recruitment and training, and administrative costs in procuring the additional rolling stock and planning the service. The annual operating cost during 2013/14 allows for costs prior to service launch e.g. staff recruitment and training, vehicle lease prior to operation and one-off project setup costs such as timetable and retail systems database modifications.

The TOC own managed operating costs are well understood and we consider that the 5% margin we have applied to these operating costs is appropriate to cover TOC margin for profit and cost risk.

Our estimate of the preferred option and the costing basis is shown below.

Cost Item	Costing Basis
ROSCO costs	Capital and non-capital lease (£110k for 153 unit)
Servicing and light maintenance	50p per vehicle mile + 20p per train mile
Diesel Fuel costs	1 veh mile per 0.75 litre @ 50p per litre
Staff costs	Costs of employment: driver £43k, conductor £32k
Network Rail usage charges	£0.0928 per vehicle mile
New route fixed infrastructure charges	£100k route-specific assumption
Capacity charges	29p per train mile
Retail commission	9% of revenue
Income related over heads (NRES, taxis etc)	5% of revenue
Station related costs	4% of revenue
TOC HQ overheads including train crew management	5% of revenue
TOTAL	

Key operating cost drivers include rolling stock choice and the approach to resourcing traincrew. Currently the Tamar Valley line is operated by drivers and conductors based in Par and Exeter. This is for reasons of history, reflecting depot locations of the former Wessex Train operating company that operated the Tamar Valley line prior to amalgamation of that franchise with the FGW high speed intercity TOC. We understand that ultimately FGW may consider transferring the Tamar Valley line work to their existing depot in Plymouth although this is by no means certain. For the purposes of evaluation and for simplicity, we have assumed that the work will have been transferred to Plymouth by the time the Tavistock line is opened.

3.4 Capital Cost

The capital costs would comprise railway route re-instatement between Bere Alston and Tavistock together with the provision of a single platform unstaffed station at Tavistock with associated forecourt and car parking provision. For the purposes of this appraisal we have estimated unit based benchmark costings for the infrastructure required. These include optimism bias contingency at a level appropriate to construction of the rail elements of the scheme.

We note that Kilbride will incur other costs associated with development of the strategy and progression through planning in the context of wider property development objectives. These are excluded from our study as being more applicable to the wider development scheme.

For the full 60 year appraisal, the appraisal is debited with the assessed level of capital outlay, assumed incurred in 2013/14.

4 APPRAISAL

4.1 Appraisal Assumptions

4.1.1 Base Case Assumption

The Tavistock route re-opening train service timetable option has been compared against a Base Case of the existing December 2009 timetable on the Tamar Valley route, and Plymouth main line, including those costs, revenues and benefits of continuing to operate the base.

4.1.2 Timetable Assumption

Our detailed timetabling work has concentrated on Monday to Fridays, as typically the level of service on these days will govern the overall resource requirement employed. At weekends a lower overall level of service would operate than weekdays and for evaluation purposes we have assumed a weekly multiplier of 6.5 for variable costs and revenues.

4.1.3 Project Life

Costs, revenues and benefits are expressed as Net Present Values 2009/10 prices. The economic and financial appraisal of the identified options is in line with DfT practice:- appraisal period over 60 years with a discount rate of 3.5% for the first 30 years falling to 3% thereafter.

No residual value is assumed.

4.1.4 Passenger Demand Profile

Our demand profiles assume implementation in 2014 with demand build up (in line with PDFH v5) of 60% in 2014, 77.5% in 2015, 90% in 2016 and full fruition thereafter.

Underlying demand growth to 2026 is based on the forecast growths resulting from detailed analysis in other studies of regional areas and equates to 4% per annum. No demand growth is assumed thereafter.

4.1.5 Fares

We calculate the yield per single journey for each flow in the demand model. In our central case we assume fares increase by 1% per annum in real terms, as does the car park charge.

We suggest that fares growth at this level can be achieved without suppressing demand. A higher fares assumption than this may reduce the subsidy requirement; however this is likely to be at the expense of reducing passenger demand somewhat and hence weakening the overall economic case.

4.1.6 Unpriced Benefits

(a) User Benefits

User benefits are calculated from the impacts in generalised journey time experienced by new and existing users of the service.

(b) Non-User Benefits

Non-user benefits have been calculated on an individual flow basis. For the Phase 2 work we have brought our assumptions in line with DCC's study of road flows. 80% of new rail users are assumed to have otherwise used road, with a car occupancy rate of 1.5 and a decongestion value of 40 pence per vehicle kilometre (assumed to be at 2009/10 prices). Since the Phase 1 work, DfT has revised its advice on the calculation of non-user benefits although their recommended values are not yet released. Our assumption of 40p reflects the severe peak congestion along most of the Tavistock road into Plymouth.

(c) Benefits Growth

Unpriced benefits per capita are assumed to grow in line with GDP per capita. We have assumed a real increase of 1% pa for this.

4.1.7 Indirect Tax Impacts

The impacts are the indirect loss to public finances through rail travel not being subject to either VAT or fuel duty. We assume that 80% of incremental trips to be made as a result of the scheme would otherwise travel a similar distance by private car. Relative modal costs and car occupancy assumptions follow DfT guidance.

4.2 DfT Scheme Appraisal

We have undertaken new demand and economic assessment for our preferred option. Our assessment of economic case assumes that operating subsidy is met by public subsidy through the franchise process or from developer contributions. We understand that Kilbride would make provision to subsidise the operation of the train service for an agreed initial period of operation. Government policy at present states that new rail services supported for three years by no DfT funds will then be considered for incorporation into the franchise agreements.

We note that section 3.2.4 of WebTAG unit 3.13.1 requires a 'fully worked up' lower cost alternative. In this case we consider that the minimal option is the preferred option – the infrastructure specification is minimal and the service level at the minimum that could be expected to meet local objectives.

4.3 Central Case in 2016

The following tables show a single year (2016) at full fruition excluding capital outlays, with all figures in £.

Tavistock Route reopening

Total view 60 years

All figures in £

2009/2010 prices

2016

Net financial effect	(£387,546)
Net economic impact	£642,122
Operating subsidy	(£387,546)

COSTS	£894,218
Capital outlays	£0
ROSCO costs	£220,000
Rolling stock service and light maintenance	£64,927
Diesel fuel	£38,961
Traincrew costs	£300,000
Network Rail variable track usage charges	£9,642
Infrastructure charges	£100,000
Network Rail capacity charges	£18,820
Retail commission	£45,600
Income related costs	£25,334
Station related costs	£20,267
HQ costs including traincrew management	£50,667

REVENUE	£506,672
Incremental Revenue	£446,119
Car Park charge revenue	£60,553

UNPRICED BENEFITS	£1,029,668
Non user Benefits	£763,411
User Benefits	£266,257

Indirect taxation impacts	£154,438
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4.4 Central Case over 60 years

We show below a summary of the 60 year appraisal period (£k PV). Our calculation assumes that the operating subsidy will be met by public funding (either directly or diverted from other public schemes) throughout. A breakdown of the first 20 individual years is presented as Appendix D.

The BCR calculation assumes that the rail new works construction capital outlays and the first three years subsidy are funded by Kilbride and this is treated as a reduction in the public sector subsidy requirement. On this basis the scheme provides a strongly worthwhile economic case.

The BCR on the scheme assessed on this basis is 3.5.

We have also assessed the project on the basis that both capital outlays and ongoing subsidy as a public sector cost to the scheme. On this basis the scheme has a weaker economic case, albeit still a positive one.

Tavistock Route reopening

Total view 60 years	NPV
All figures in £ 2009/2010 prices	60 years
Net financial effect	(£17,512,798)
Net economic impact	£36,568,028
Operating subsidy	(£3,487,677)
COSTS	£30,006,128
Capital outlays	£14,025,121
ROSCO costs	£5,658,288
Rolling stock service and light maintenance	£1,669,894
Diesel fuel	£1,002,057
Traincrew costs	£7,715,847
Network Rail variable track usage charges	£247,976
Infrastructure charges	£5,884,066
Network Rail capacity charges	£484,037
Retail commission	£2,395,054
Income related costs	£1,330,586
Station related costs	£1,064,469
HQ costs including traincrew management	£2,647,118
REVENUE	£26,611,715
Incremental Revenue	£23,431,319
Car Park charge revenue	£3,180,396
UNPRICED BENEFITS	£54,080,825
Non user Benefits	£40,096,334
User Benefits	£13,984,491
Indirect taxation impacts	£8,341,228
BCR (assuming that Kilbride's financial contribution of capex and first three years operating subsidy are not debited to public purse)	3.5

4.5 Early Years Subsidy Requirement

The current Great Western franchise commenced on 1st April 2006 for a duration of seven years with a further three years subject to achieving performance targets. Kilbride are proposing to fund the early years subsidy of the scheme as the service develops, which equates to a net contribution of approximately £1.2m, in addition to the capital costs of reinstating the rail line.

APPENDIX A CLASS 153 ROLLING STOCK

Class 153



The class 153 is a 23m long single car train converted in 1991-2 from 2-car class 155 units built in 1987-8. They have a top speed of 75mph and are able to seat up to 75 passengers. The units operated by First Great Western have recently been refurbished as shown in the following picture. These vehicles can be coupled to form multiple units.

