Somerset County Council/Langport Transport Group

RYR LANGPORT-SOMERTON AREA

Rail Demand Forecasting Methodology

JANUARY 2022

CONFIDENTIAL

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WSP

1st Floor, Keble House
Southernhay Gardens, Southernhay East
Exeter, Devon
EX1 1NT

Phone: +44 1392 267 500

Fax: +44 1392 267 599

WSP.com

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Signature				
Authorised by	Nick King	Nick King		
Signature				
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APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

1.1.1. WSP has been commissioned by Somerset County Council (SCC) and Langport Transport Group (LTG) to produce a Strategic Outline Business Case for a Restore Your Railways (RYR) Ideas Fund Funding Bid to the Department for Transport. The funding bid is for the opening of a new rail station in the Langport-Somerton area of South Somerset. This technical note outlines the approach used for evaluating the potential rail passenger demand.

1.1.2. Langport and Somerton were served by a passenger railway service on the Reading to Taunton line until the 1960s when the stations in each town were closed. This section of the Reading to Taunton is now one of the longest sections of railway in the country without a railway station. Those with access to private transport need to travel long distances to access the rail network. For those without access to a car the situation is worse with a choice between indirect and infrequent bus services or expensive taxi services limiting access to essential services and employment opportunities.

1.1.3. Langport and Somerton are growing communities with new housing and employment planned in both communities to support their role as market towns providing services and facilities for a large hinterland of smaller rural communities. Sustainable transport links to support this growth are a key to the future prosperity of the communities.

1.1.4. The demand modelling has been completed on the basis of the 2018/19 population and station demands; with anticipated new housing developments added on top of the forecast. In addition, the demand modelling results have been used to estimate the number of car parking spaces required for the new station.

2 MODELLING APPROACH - TRIP RATE MODEL

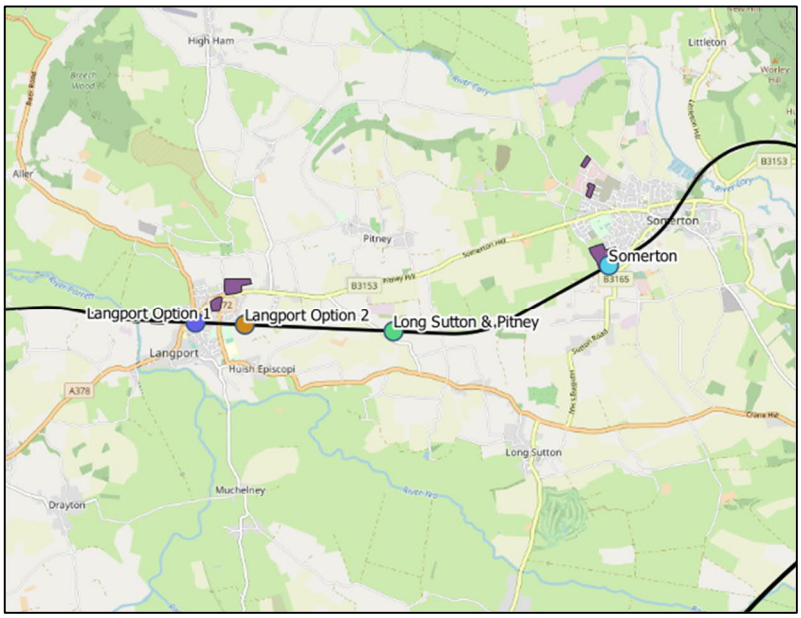
2.1 OVERVIEW

2.1.1. A trip rate model[1] has been developed to forecast rail demand for four potential sites for the Langport-Somerton station:

- Langport Option 1 – located in the centre of Langport, at the same place as the previous Langport station.
- Langport Option 2 – located just east of Langport.
- Long Sutton & Pitney – located at Tengore Lane, roughly halfway between Langport and Somerton.
- Somerton – located just south-west of Somerton

These site locations are shown in Figure 2-1. The trip rate model was developed using observed station usage data (from Office of Road and Rail) along with recent population data (Experian Mosaic).

Figure 2-1 - Station location options



2.1.2. The forecast demand for Langport-Somerton is based on an observed number of trips taken (trip rate) per distance catchment away from existing stations. Calibration of the trip rates has been based on a set of stations which have been chosen to have similar characteristics (e.g. population proximity and service frequency) to that expected for Langport-Somerton. Trip rates are then used with population data for the location of the proposed new station to give a station demand estimate.

[1] Trip rate models estimate the likely demand for a station by using a catchment, or catchments, around the station together with an assumed or derived number of journeys per head of population in the catchment(s).

Figure 2-2 - Overarching modelling approach flowchart

2.1.3. In order to develop the trip rate model, observed demand data from existing stations in the South West and South East of England were considered. A selection procedure was undertaken with the aim to select stations with similar properties such as the level of service and seeking locations with similar demography to that of Langport-Somerton.

2.1.4. An initial selection of stations within Somerset and its neighbouring counties was completed to identify similar stations which see between 20 and 60 services per day to broadly mirror the expected hourly frequency at Langport-Somerton. A subset of these stations was selected that served rural market towns or otherwise could be expected to display a reasonably similar travel pattern to Langport-Somerton, and these were used for calibration of the trip rates.

2.1.5. Station demand from Office of Rail and Road (ORR) 2018/19 Annual Station Usage Statistics were used to understand total Stations Entry and Exit figures for each reference station for the trip rate model. Experian's Mosaic dataset was used for current (2018/19) population estimates of all households. The population data was categorised using non-overlapping 1, 2, 5, 10 and >10km straight-line catchments for the reference stations; this was done with and without including catchments for the new station location.

2.1.6. Figure 2-3 shows all rail stations in the selected geography. The selected calibration / reference stations identified with similar service characteristics are highlighted as red dots, and the station names can be found in Table 2-1.

Figure 2-3 - Calibration Stations

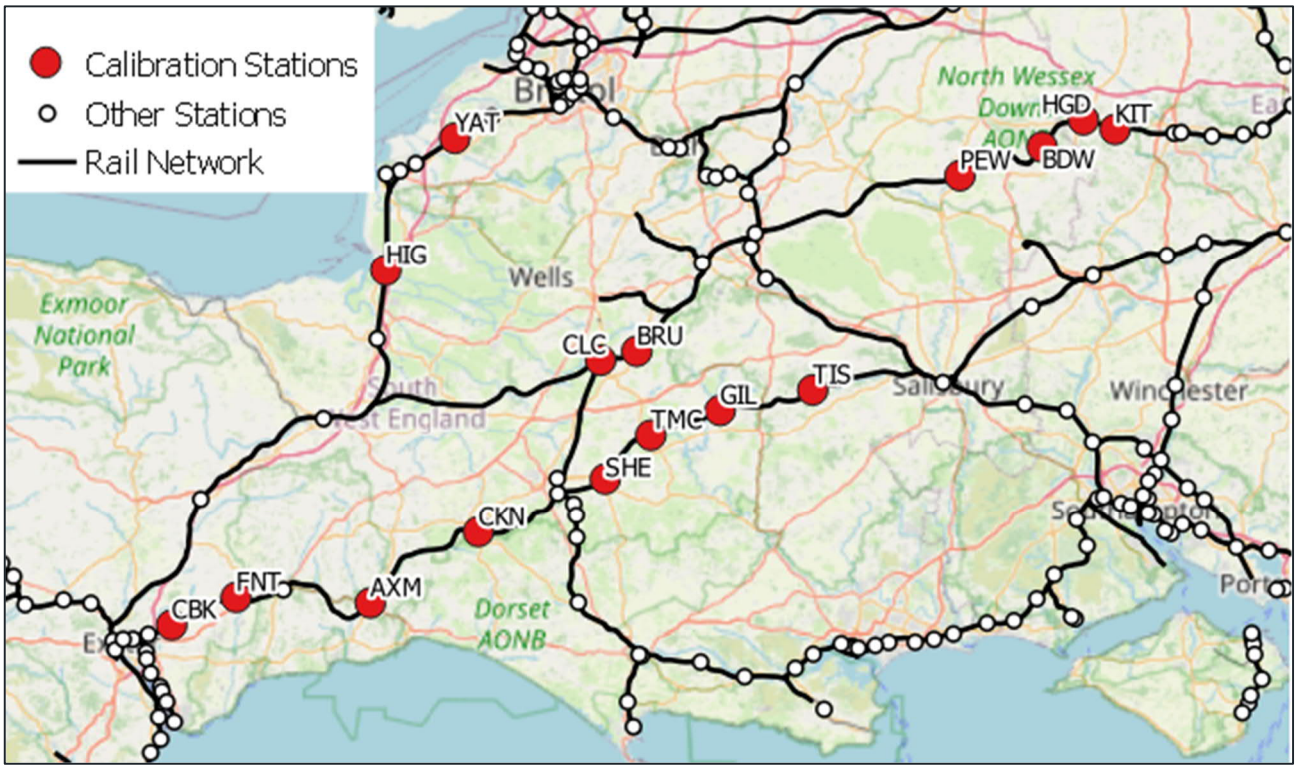


Table 2-1 – Calibration Stations

Station code	Station name		Station code	Station name
AXM	Axminster		HIG	Highbridge & Burnham
BDW	Bedwyn		HGD	Hungerford
BRU	Bruton		KIT	Kintbury
CLC	Castle Cary		PEW	Pewsey
CBK	Cranbrook (Devon)		SHE	Sherborne
CKN	Crewkerne		TMC	Templecombe
FNT	Feniton		TIS	Tisbury
GIL	Gillingham		YAT	Yatton

2.1.7. The population in each catchment was assigned a trip rate (the number of trips each weekday expected per 100 residents[2]) - applicable to the number of residents over 15 as reported by Experian Mosaic data. The total number of trips estimated for each station is then adjusted using an elasticity to the train frequency - trains per hour (tph) – this is done to reflect the view that a better served station will generate more demand from the same catchment population.

2.1.8. While population and service frequency are considered by the model it should be noted that the trip rate model implicitly assumes the onward connectivity from any new station(s) modelled will be broadly similar to these calibration stations.

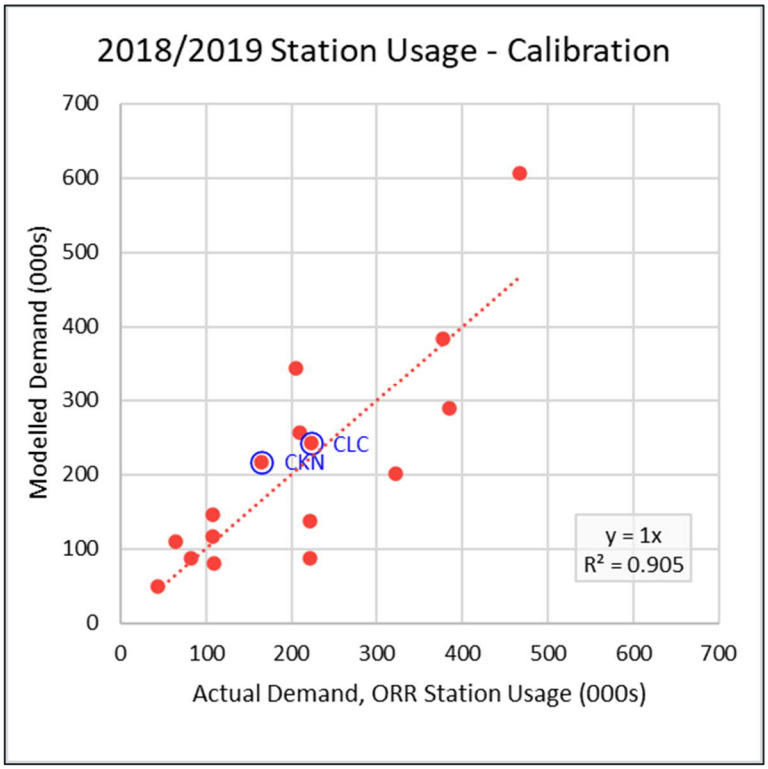
2.1.9. The elasticity to train frequency and the trip rates for each distance band were determined by calibration to the annual station usage figures as reported by ORR.

2.1.10. The trip rate calibration results can be seen in Figure 2-4. This shows how the modelled / trip rate and catchment-based demand estimates (vertical axis) compare to the real-world station demands as reported by ORR (horizontal axis). The dotted line is the best fit line; this y=1x fit line demonstrates that the model behaves well in that there is no systematic bias where low or high levels of demand are under or over reported. The R2 term is also shown to be 0.905, which indicates a strong correlation. Calibration of the trip rates has been undertaken by seeking to optimise this R2 value, while keeping the y=1x gradient. The strong positive correlation indicates that the modelled station demand can be expected to be a reasonable estimate of the true demand.

[2] While the calibrated input is trips / 100 people per weekday, this is always used with an annualization factor (which is fixed at 300) so the model actually considers trips per person per year - this is compared with annual Station Usage Data from ORR. Trips per weekday is used as an input only because this is a more intuitive measure. The choice of annualization factor does not impact the model results since all calibration is done on using annualised demand.

The graphic also shows Castle Cary and Crewkerne highlighted with blue circles. Compared to the proposed Langport-Somerton station, they also have train frequencies around 1tph, serve rural market towns, and are located in South Somerset. They fit reasonably well to the calibrated parameters.

Figure 2-4 - Trip Rate Calibration



2.1.1. Table 2-2 shows the calibrated trip rate figures. The 1km catchment has the highest trip rate, indicating that forecast rail demand is largely determined by 1km catchment i.e. that population which is within 10 minutes walking time of the station.

Table 2-2 – Trip rates per distance catchment

Distance Catchment	< 1km	1-2km	2-5km	5-10km	> 10km
Trips per weekday per 100 people	10.27	4.49	2.58	1.51	0.97

2.1.2. Table 2-3 lists the calibrated train frequency adjustment parameters. The tph elasticity used was 1.1, indicating that people are more likely to use a station more frequently when the train frequency is improved.

Table 2-3 – TPH adjustment parameters

	Value
Average TPH	1.25
TPH Elasticity	1.11

2.2 HOUSING DEVELOPMENTS

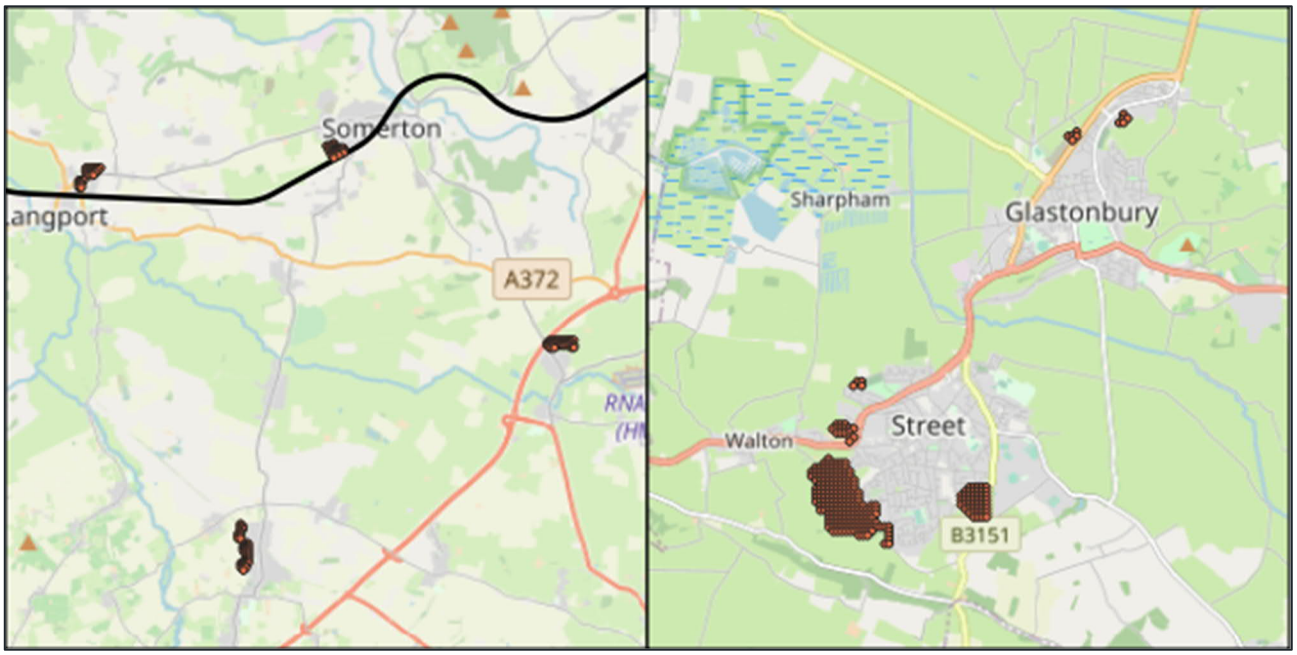
2.2.1. The model has been calibrated against observed population and demand data for existing stations – however in order to assess the forecast demand for the proposed new stations the impact of the demand generated by the housing and employment developments which are yet to be built also needs to be considered.

2.2.2. The SSDC Emerging Local Plan Review gives the quantum of housing developments to be built across Langport, Somerton, Martock and Ilchester over the Local Plan period as being 730 dwellings. In addition, 924 dwellings are expected to be built in Street and Glastonbury according to the Mendip Local Plan. In order to reflect the longer term additional growth of Langport-Somerton beyond the current plan period, a longer term demand scenario has been modelled as part of the economic forecasting process. The impact of the new housing development is assessed using the trip rate model by translating the planned new dwellings into an estimated new population. This is assessed within the same station catchment bands and trip rates used when considering the existing residential population.

2.2.3. The new population is assumed to be spread evenly within each site. Assigning each whole site to one catchment band (for example, by a site's centroid) would not necessarily reflect the true spatial characteristics of trip rates as they vary by distance, especially given the 1km catchment has a significantly higher trip rate.

2.2.4. As illustrated by Figure 2-5, it has been assumed that new population will be distributed uniformly within each site. Each site is divided up into a number of equal sized cells, and it is assumed that each cell contains the same population.

Figure 2-5 – Housing sites in South Somerset (L) and Street/Glastonbury (R)



2.2.5. The population associated with each of the cells is then used as an additional layer of population in the spreadsheet-based trip rate model. Each cell of this new population is then assigned to a station with a distance band.

2.2.6. The trip rate model then assesses the rail demand from each cell using the same calibrated trip rates as used for the existing population from Experian Mosaic data.

2.2.7. Table 2-4 lists the housing development sites and Table 2-5 below lists the assumptions applied for these sites in South Somerset and Street/Glastonbury. The occupancy rate of 2.2 is based on the average household size within South Somerset and Mendip.

Table 2-4 – Housing Developments

Development location	Local Plan Policy	Dwellings
South Somerset		
Langport	LH1	80
	LH2	100
Somerton	SM1	140
Martock	MB1	55
	MB2	95
	MB3	60
Ilchester	IL1	200
Mendip		
Street	ST1	280
	ST2	32
	ST3	430
	ST4	70
Glastonbury	GL1	62
	GL2	50

Table 2-5 – South Somerset and Street/Glastonbury New Housing Development Assumptions

Period	Total Dwellings	Total Population (15+)
2021 - 2036	1,654	3,619

3 RESULTS

3.1 INTRODUCTION

3.1.1. In order to be consistent with scheme appraisal best practice it is necessary to separate out the impacts of demand growth and scheme intervention. In order to do this, the trip generation and attraction of both local development and the construction of the new stations have been examined separately. This allows the analysis to demonstrate to decision makers the impacts on rail demand with and without the developments and with and without the new stations.

3.1.2. Due to overlap between the proposed Langport-Somerton station catchments and existing station catchments, abstraction from the existing stations is to be expected. Abstraction is deemed to occur where station demand in a 'with housing development but without new station(s) scenario', transfers to a new station when that is also included in the modelling. Demand changes at existing stations is therefore highlighted in each sub-section below as well as the demand for the new station.

3.1.3. The trip rate model produces a waterfall chart summarising the overall change of annual rail trips across both stations. In each case the figures show the build-up of demand at the new station in the following stages:

(A) Base Demand: the demand at existing stations based on observed 2018/19 station usage statistics from the ORR with no new housing or employment development;
(B) New Housing: the demand generated by new housing in the area and which could use the existing stations;
(C) New Station Demand (Housing): the demand generated from the population at the new housing developments within the catchment of the new station;
(D) New Station Abstraction: the demand which would have used using existing stations (including users from new housing developments) that now choose the new station option;
(E) New Demand Reduced Distance: the demand generated from the existing population that is new-to-rail (due to increased trip rates linked to a closer proximity to a station);
(F) Forecast Total Demand: the total number of trips made by rail across existing stations and the new station scenario;

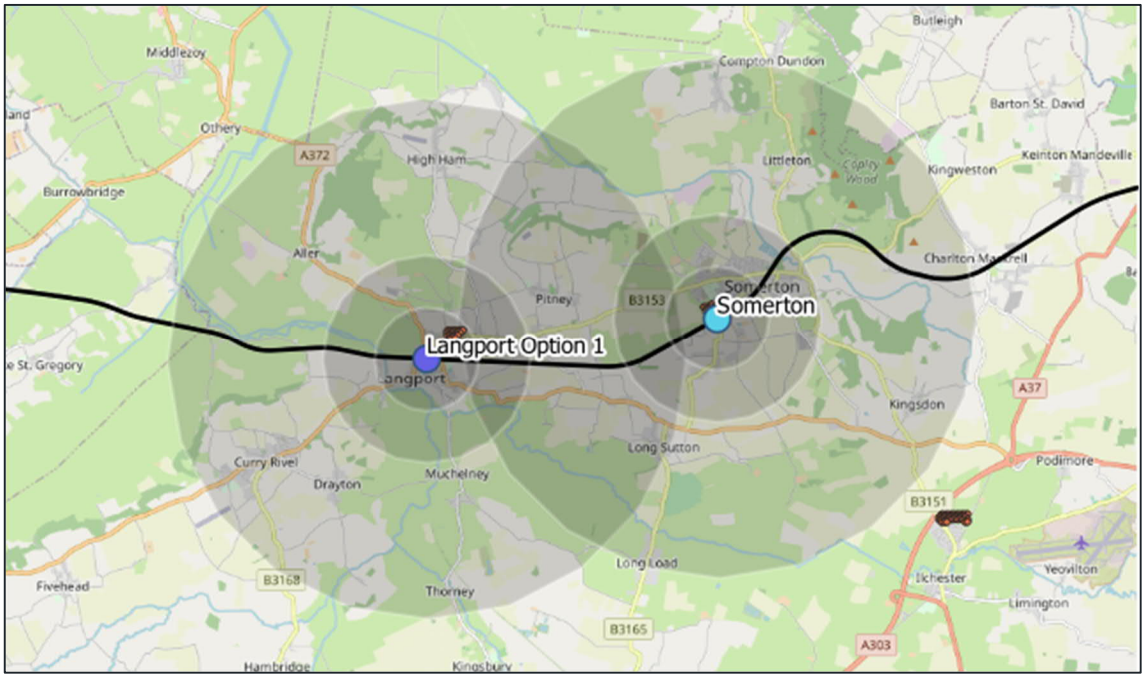
- C+E is the forecast gross total annual trips to the new station in isolation; and
- C+D+E is the forecast net total annual trips to rail across the study area.

3.2 RAIL DEMAND FORECAST

3.2.1. The following figures show the catchments for the eastmost and westmost Langport-Somerton options (Langport Option 1 and Somerton) to illustrate the range of catchments. Figure 3-1 shows the 1, 2 and 5km catchments, Figure 3-2 shows the 10km catchment for the other existing stations in the area and Figure 3-3 shows the >10km catchment for all stations. 1km represents a typical walking catchment and population within this area is a key driver of station demand, while the driving catchment for a station is bigger than a typical walking catchment, so that 2km or even 5km is more suitable. The orange dots show new housing which is based on the development sites. The population within each site is assumed to be uniformly distributed.

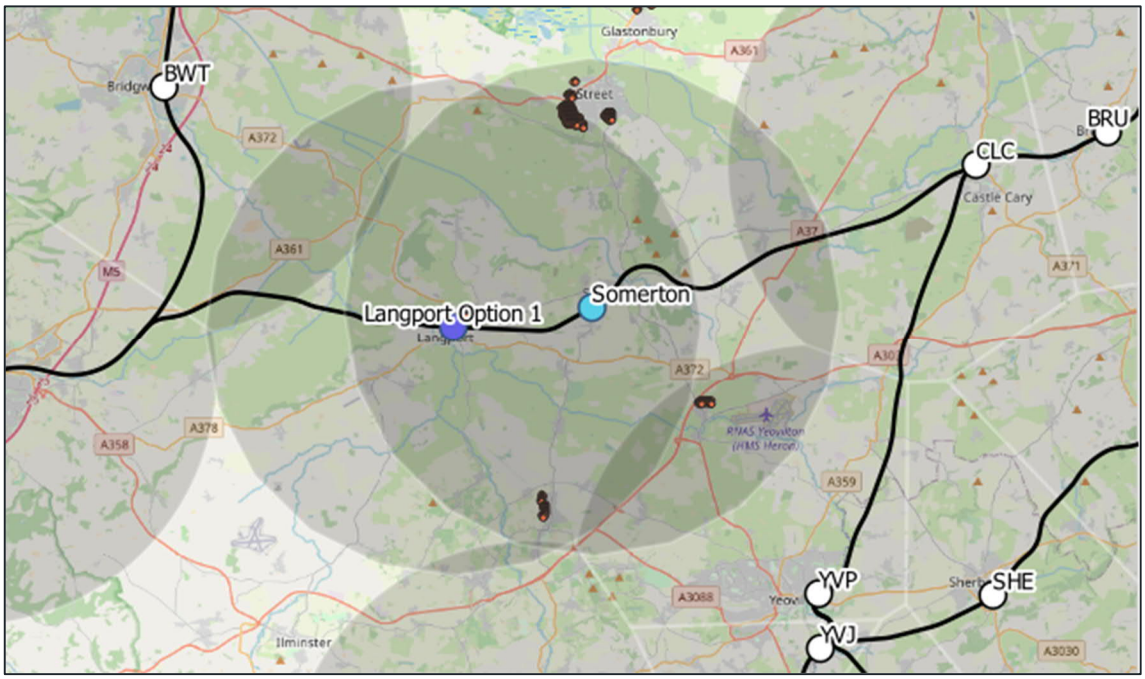
3.2.2. Figure 3-1 shows clearly that a station at either Langport or Somerton would cover the corresponding town in the 2km catchments, while the 5km catchments would mainly cover smaller settlements in the area.

Figure 3-1 - Station catchments (up to 5km)



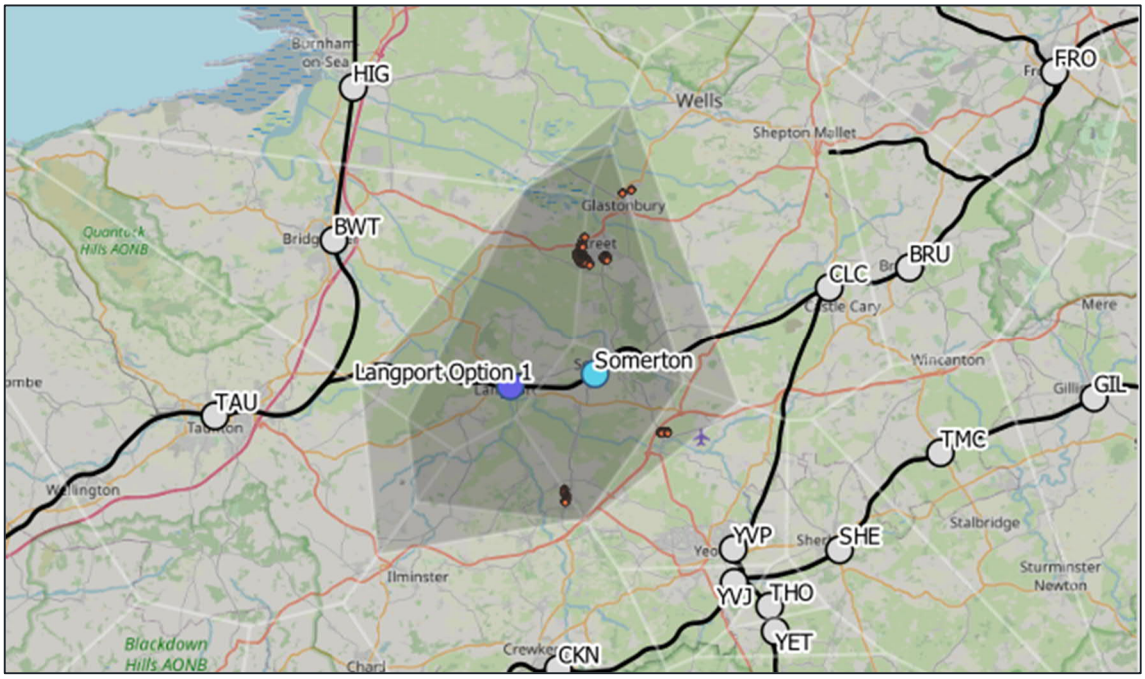
3.2.3. Figure 3-2 shows that a station at Somerton would cover all of Street, Martock and Ilchester within its 10km catchment while Langport Option 1 would cover Martock and partially cover Street. In terms of abstraction, the 10km catchment for Langport Option 1 mainly overlaps with the Bridgwater catchment while the 10km catchment for Somerton overlaps with the Castle Cary and Yeovil Pen Mill catchments.

Figure 3-2 - Station catchments (10km)



3.2.4. Figure 3-3 shows the complete station catchments beyond 10km. However, it should be noted that using straight-line distances to calculate catchments tends to be less accurate for these longer distances, since they do not take account of the road network and services provided by the stations.

Figure 3-3 - Station catchments (>10km)



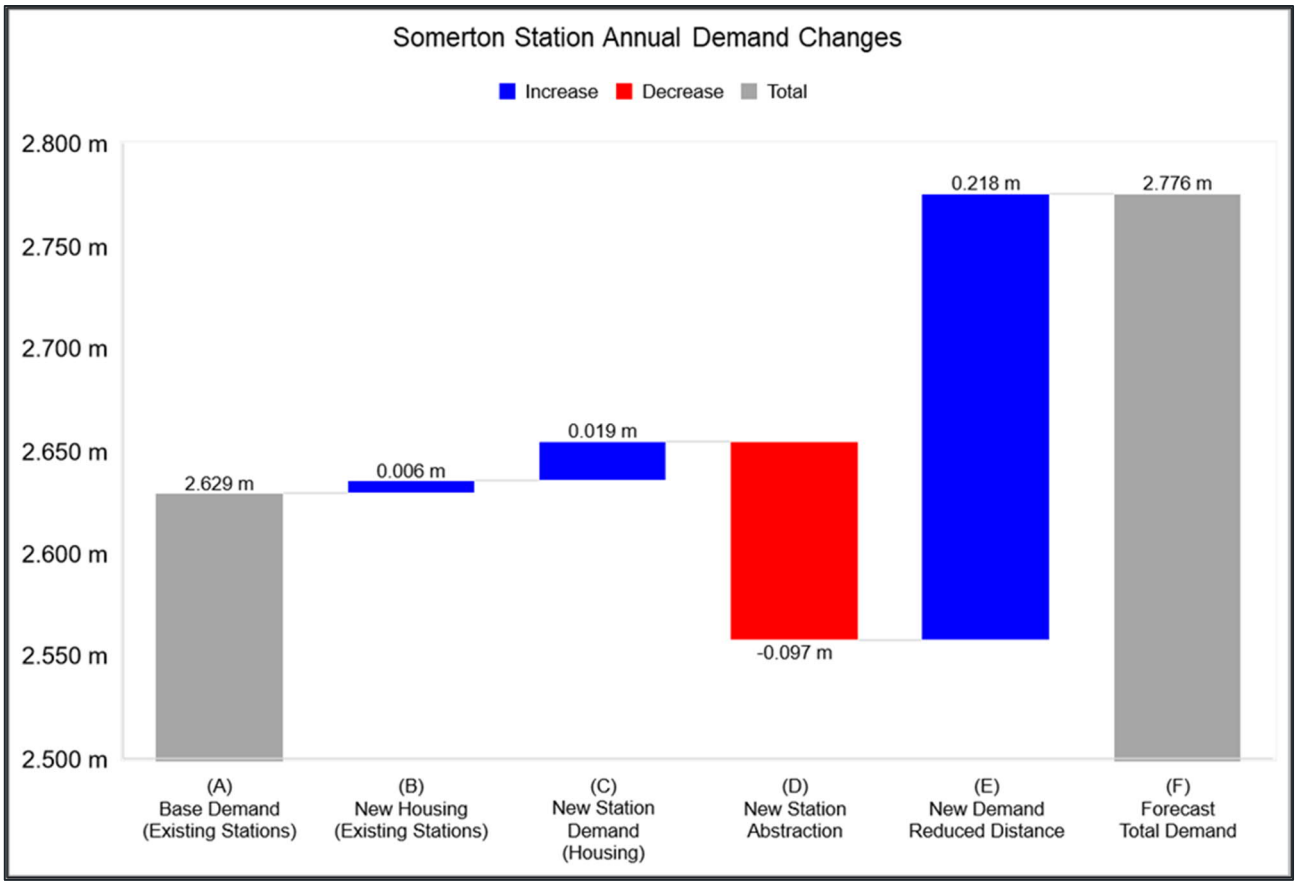
Demand for an hourly service

3.2.5. The full forecast demand results are shown in Table 3-1 below, and a waterfall chart showing the build-up of demand for the Somerton location is shown in Figure 3-4 below. Waterfall charts for all station options can be found in Appendix A. The data shown in the chart relates to the demand associated with full development build out of all Local Plan housing sites.

Table 3-1 - Summarised Net Impact of Langport-Somerton stations on Rail Demand (000s journeys / year)

Option	(A) Base Demand (Existing Stations)	(B) New Housing (Existing Stations)	(C) New Station Demand (Housing)	(D) New Station Abstraction	(E) New Demand Reduced Distance	(F) Forecast Total Demand	Forecast Annual Trips via this Station (C+E)	Net Additional Trips to Rail (C+D+E)
Langport 1	2,629	6	18	-87	200	2,767	219	131
Langport 2	2,629	6	19	-90	204	2,768	223	133
Long Sutton	2,629	6	14	-94	174	2,729	188	94
Somerton	2,629	6	19	-97	218	2,776	237	140

Figure 3-4 - Calculated Langport-Somerton Annual Rail Demand at 2018/2019 Demand Level (Somerton Option)



3.2.6. The results indicate that 6,000 annual rail trips are expected to be generated from the planned housing sites. This is calculated based on existing rail stations only. This forms the new base and the impact of the new station is then compared to this level. It is understood that the housing will be developed regardless of the new station.

3.2.7. The Somerton station option has the highest annual rail demand at 237,000 journeys, of which 41% is abstracted demand from the existing stations. This is to be expected given the slightly larger population of Somerton compared to Langport and its proximity to Street and Glastonbury. The Langport station options have very similar rail demands, with Option 2 having the slightly higher demand of 223,000 journeys, of which 40% is abstracted demand. The Long Sutton option has the lowest annual rail demand at 188,000 journeys, of which 50% is abstracted demand.

Demand for a two-hourly service

3.2.8. In addition, the demand was modelled for a scenario where the new station is served by a two-hourly service. The nature of how the demand model assigns population to stations (Thiessen polygons) and how it adjusts demand according to service frequency means that the proportion of abstracted and new-to-rail passengers is more accurate when the nearby existing stations have similar train frequencies to the new station. In this case most of the nearby stations have roughly hourly service frequencies, so while the demand results above for an hourly service give a reasonable level of abstraction, this may not have been the case for a two-hourly service. To address this possible overstatement of abstraction the total level of demand for a two-hourly service

has been calculated using the model (model calibration is on the basis of total demand so there is no reason to doubt the model's demand total), but the proportion of abstracted passengers is assumed to be the same as for the hourly results.

3.2.9. Table 3-2 below summarises the demand results for both hourly and two-hourly services for the two station options with the highest demand, Langport Option 2 and Somerton. It can be seen that the demand for the two-hourly service is about 46% of that of an hourly service.

Table 3-2 – Annual demand forecasts for hourly and two-hourly service frequencies

Hourly service	Langport Option 2		Somerton	
Annual Demand	2018/19 level	2018/19 level plus developments	2018/19 level	2018/19 level plus developments
Total demand	205,112	223,200	218,443	237,211
New-to-rail Demand	120,420	132,919	127,920	140,266
Abstracted Demand	84,692	90,281	90,523	96,945

Two-hourly service	Langport Option 2		Somerton	
Annual Demand	2018/19 level	2018/19 level plus developments	2018/19 level	2018/19 level plus developments
Total demand	94,706	103,058	100,862	109,527
New-to-rail Demand	55,601	61,372	59,064	64,765
Abstracted Demand	39,105	41,685	41,797	44,762

3.3 PARKING DEMAND

3.3.1. An exercise has been carried out to estimate the number of parking spaces required at a new Langport-Somerton station by using the demand forecasts to estimate the number of daily car arrivals.

3.3.2. Starting with the number of daily passengers by each distance catchment, car mode shares by distance (NTS table 0308[3]) were applied. Since the demand forecast does not specify the directionality of passengers, census journey to work data (census table WF01BEW) was used as a proxy for the proportion of outbound passengers. The proportion used was that of workers living in the Langport-Somerton area who commuted to a workplace outside of the Langport-Somerton area compared to the number of the workers commuting to Langport-Somerton from outside the area. Table 3-3 shows the results of these calculations.

Table 3-3 – Langport-Somerton estimate of daily passengers arriving by car

Option	Daily passengers	Daily outbound passengers	Daily outbound passengers (arriving by car)
Langport Option 1	729	452	274
Langport Option 2	744	461	282
Long Sutton	628	389	306
Somerton	791	490	307

3.3.3. The journey purpose split for passengers was assumed to be the 'surface rail' purpose split from NTS table 0409. This purpose split was used in conjunction with the average car occupancy (NTS table 0905) to calculate the daily car arrivals at the station. These purpose splits were further used with rail tour proportions to get an indication of the car arrival/departure profile at the station, which is shown in Table 3-4.

[3] In order to apply the NTS distance bands (miles) to the passengers in the demand forecast distance bands (kilometres), it was assumed that the population was linearly distributed within each demand forecast distance band. London-related transport modes were excluded when calculating the car mode share.

Table 3-4 – Langport-Somerton estimated daily car arrival profile

Option	Direction	Time period				Daily car arrivals
		AM (7-10)	IP (10-16)	PM (16-19)	OP (19-7)	
Langport Option 1	Arrivals	128	54	12	15	209
	Departures	10	67	101	30	
Langport Option 2	Arrivals	132	56	12	15	215
	Departures	10	69	104	31	
Long Sutton	Arrivals	143	60	13	16	233
	Departures	11	75	113	34	
Somerton	Arrivals	143	61	13	16	234
	Departures	11	75	113	34	

3.3.4. These results indicate that the total car arrivals do not vary significantly between each station option. The Somerton option has the largest number of car arrivals at 234, and there would be a net 132 arrivals at the station in the AM period.

3.3.5. The current DfT recommendation for rail forecasting is to assume a medium COVID impact scenario – in this scenario long-term rail demand and revenue is expected to be ~83% of pre-COVID predictions. By applying this assumption to the station forecast demand, there would be a net 110 arrivals at the station in the AM period. Providing around 100 car parking spaces is therefore expected to be sufficient to meet the demand for any of the station options. The estimation of the Langport-Somerton car parking requirement will be refined at the next stage.

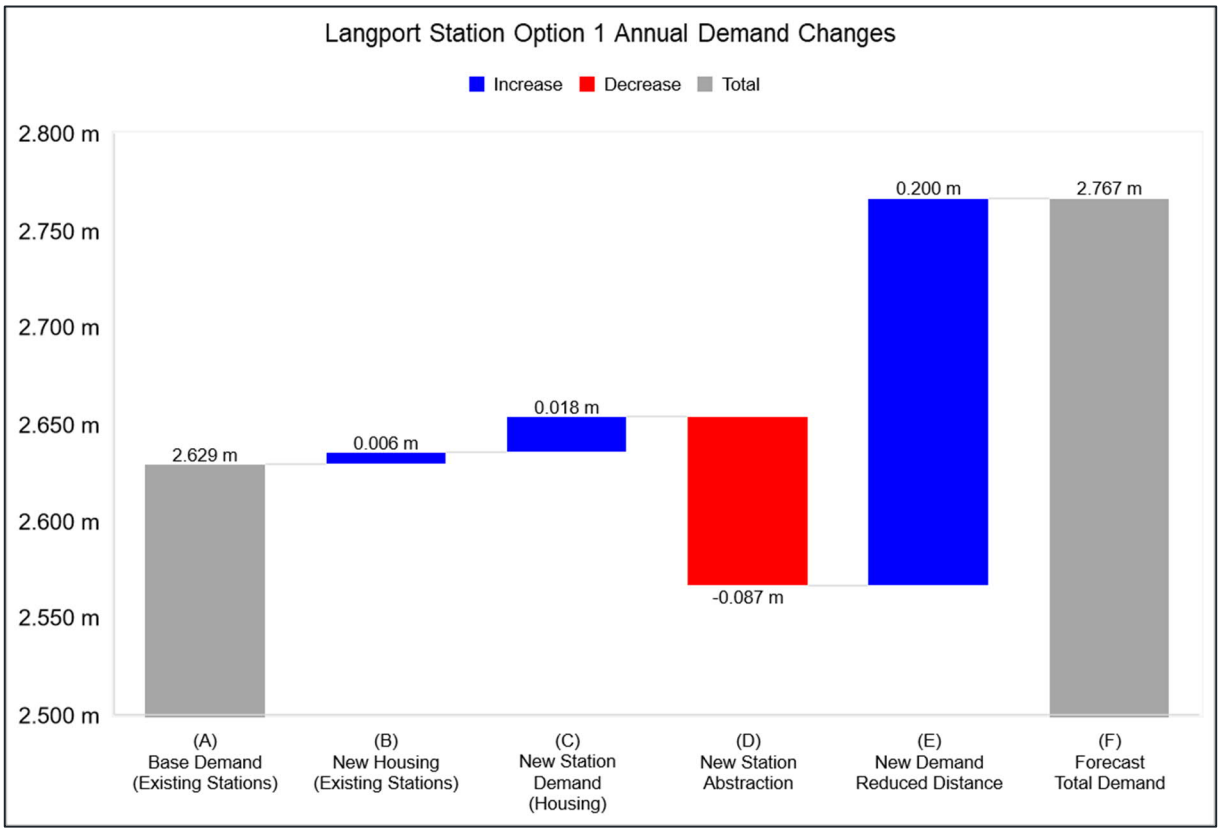
4 SUMMARY

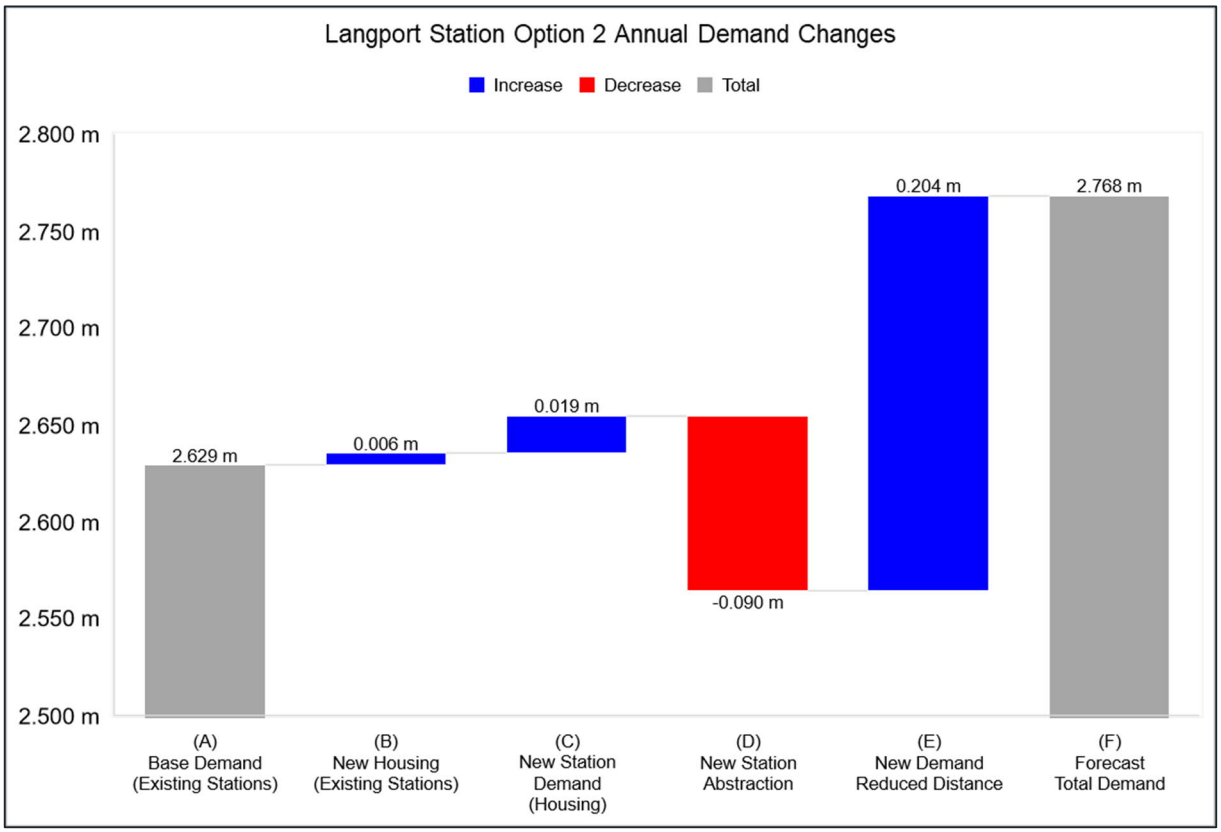
4.1.1. The passenger demand for four potential sites for a new rail station in the Langport-Somerton area was calculated using a trip rate model based on 2018/2019 population and station usage. The trip rates were calibrated using data for nearby stations with reasonably similar characteristics (catchment population and hourly train frequencies) to the proposed station. Abstraction from existing stations and demand from planned housing developments in the area were both included in the demand calculations. The demand results showed that the Somerton option would have the highest annual demand (237,000 journeys), followed by Langport Option 2 (223,000), Langport Option 1 (219,000), then Long Sutton (188,000). The demand for a two-hourly service frequency was about 46% of the demand for an hourly service, with the Somerton option having a demand of 110,000 journeys and Langport Option 2 having a demand of 103,000 journeys.

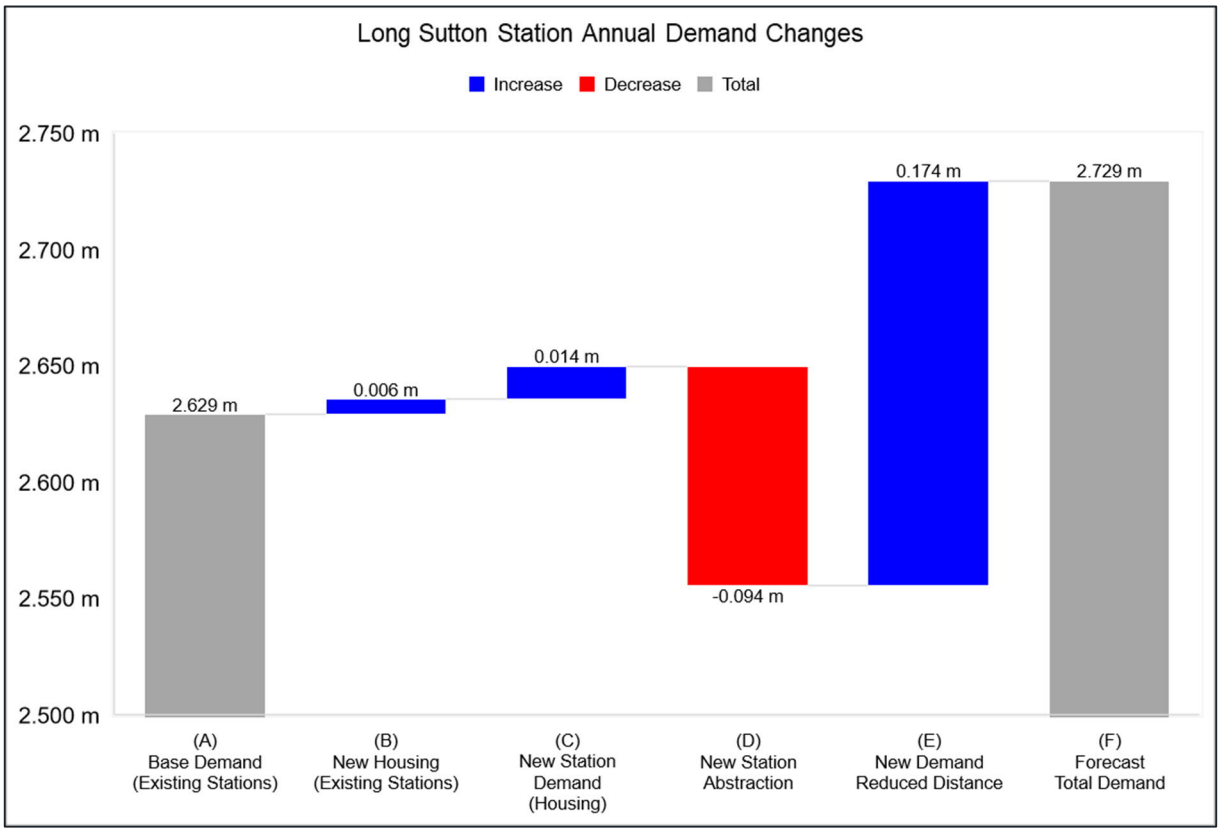
4.1.2. The number of car parking spaces required for the new station was calculated by using NTS data and census data to estimate what proportion of the new station demand would be arriving by car. The results indicated that around 100 car parking spaces would be sufficient to meet the expected demand for any of the station options, though this will be refined at the next stage.

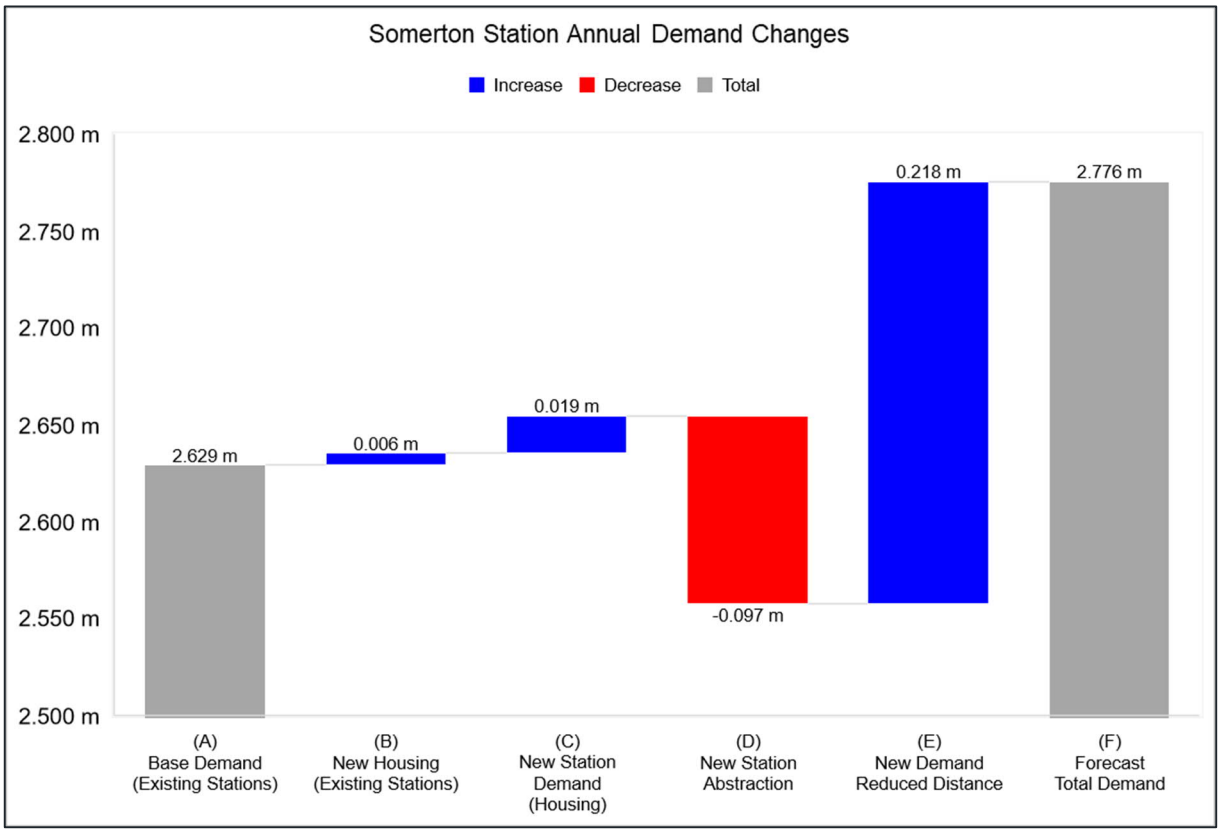
Appendix A

RAIL DEMAND GRAPHS


Langport Station Option 1 Annual Demand Changes
Increase
Decrease
Total
2.800 m
2.750 m
2.700 m
2.650 m
2.600 m
2.550 m
2.500 m
2.629 m
0.006 m
0.018 m
-0.087 m
0.200 m
2.767 m
(A) Base Demand (Existing Stations)
(B) New Housing (Existing Stations)
(C) New Station Demand (Housing)
(D) New Station Abstraction
(E) New Demand Reduced Distance
(F) Forecast Total Demand


Langport Station Option 2 Annual Demand Changes
Increase
Decrease
Total
2.800 m
2.750 m
2.700 m
2.650 m
2.600 m
2.550 m
2.500 m
2.629 m
0.006 m
0.019 m
-0.090 m
0.204 m
2.768 m
(A) Base Demand (Existing Stations)
(B) New Housing (Existing Stations)
(C) New Station Demand (Housing)
(D) New Station Abstraction
(E) New Demand Reduced Distance
(F) Forecast Total Demand


Long Sutton Station Annual Demand Changes
Increase
Decrease
Total
2.750 m
2.700 m
2.650 m
2.600 m
2.550 m
2.500 m
2.629 m
0.006 m
0.014 m
-0.094 m
0.174 m
2.729 m
(A) Base Demand (Existing Stations)
(B) New Housing (Existing Stations)
(C) New Station Demand (Housing)
(D) New Station Abstraction
(E) New Demand Reduced Distance
(F) Forecast Total Demand


Somerton Station Annual Demand Changes
Increase
Decrease
Total
2.800 m
2.750 m
2.700 m
2.650 m
2.600 m
2.550 m
2.500 m
2.629 m
0.006 m
0.019 m
-0.097 m
0.218 m
2.776 m
(A) Base Demand (Existing Stations)
(B) New Housing (Existing Stations)
(C) New Station Demand (Housing)
(D) New Station Abstraction
(E) New Demand Reduced Distance
(F) Forecast Total Demand

1st Floor, Keble House
Southernhay Gardens, Southernhay East
Exeter, Devon
EX1 1NT

wsp.com