Turnford Station

Strategic Outline Business Case

Broxbourne Borough Council

Project Number: 60557650

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Quality information

Prepared by	Checked by	Approved by
Andrew Coates	Andrew Coates	Caroline Moore
Principal Consultant	Principal Consultant	Associate Director
Simon Pierce		
Consultant		

Revision History

Revision	Revision date	Details	Authorized	Name	Position

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Prepared for:

Broxbourne Borough Council

Prepared by:

Andrew Coates
Principal Consultant
T: 01727 535412
E: andrew.m.coates@aecom.com

AECOM Limited
AECOM House
63-77 Victoria Street
St Albans
Hertfordshire
AL1 3ER
UK

T: +44(0)1727 535000
aecom.com

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1.   Introduction

AECOM was appointed by Broxbourne Borough Council (BBC) in 2018 to identify the potential for a business case for a new railway station at Turnford, an area between Cheshunt and Broxbourne in the West Anglia Mainline. The starting assumption has been that the station should be delivered as part of Crossrail 2 (CR2) and BBC have been working with the joint Network Rail (NR) and Transport for London (TfL) CR2 team to identify potential suitable locations, and appointed AECOM to initially assess the preferred location to understand the potential case for a new station in the area. This culminated in the development of an early Strategic Outline Business Case (SOBC) which was reported to BBC in 2018, and forms the main body of this report.

Subsequent work (during 2019 and 2020) has considered the situation where CR2 is not implemented, as BBC wish to understand the potential business case if CR2 were not to go ahead, or whether the new station could be brought forward and opened in advance of CR2. The first stage of this work was undertaking operational analysis which demonstrated that, without CR2, services could stop at a new station without significantly impacting the wider timetable. This is initial high-level analysis and does not include performance impact and would require discussion with NR and the Train Operating Companies (TOCs). However, this analysis has shown that an additional stop could be accommodated with some minor amendments to the base timetable.

This updated report now includes the Economic Case analysis for a new station at Turnford assuming that Crossrail 2 does not go ahead. The opportunity has also been undertaken to update the Department for Transport (DfT) Transport Analysis Guidance (TAG) and Passenger Demand Forecasting Council's (PDFC) Passenger Demand Forecasting handbook (PDFH) guidance from that current during the first phase of work (as at Autumn 2017) to the latest guidance as at early 2020.

As noted earlier, the main body of this report is therefore the original analysis as at early 2018, with updated 'without CR2', TAG and PDFH guidance tests all included in Section 3.16. It should be noted therefore, that much of the Strategic Case outlined is from older planning forecasts, guidance documents etc. as current at the time, and will be reviewed and updated.

1.1   Department for Transport Business Case Process

The structure of this report follows the DfT 'five case business case' guidance[1] on presenting and assessing business cases, which is consistent with the Treasury 'Green Book'.

There are three phases to the transport Business Case development process, and this assessment is at an early stage of Phase One (SOBC).

Figure 1: The Three Phases of the DfT Decision Making Process

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[1] https://www.gov.uk/government/publications/transport-business-case

The purpose of the SOBC, as defined by DfT, is to:

- define the scope of the project/programme and its outputs and benefits;
- make the case for change;
- confirm the strategic fit with the Departmental business plan and wider Government objectives;
- state the assumptions made;
- set out how achievements will be measured;
- outline options, including innovative options, to tackle the problem and carry out initial sift of options;
- consider and confirm that a robust project governance structure is in place and that the project is affordable;
- outline the sequence in which the project and benefits will be delivered;
- identify and analyse its stakeholders; and
- confirm the assurance arrangements.

Following this introductory chapter, the rest of the report is structured as follows:

Section 2 outlines the initial Strategic Case for the scheme, demonstrating the case for change, with a clear rationale for making the investment and how it fits with the aims of BBC and national bodies. This section also describes the location and the scheme.

Section 3 makes the Economic Case for the scheme, outlining the costs and benefits and the resulting value for money analysis. Economic, environmental, social and distributional impacts are all examined, using qualitative, quantitative and monetised information. Three additional tests have been conducted; assessing with and without CR2 under revised TAG and PDFH values

Section 4 summarises the initial known Financial Case for the scheme, and at this stage summarising some potential funding arrangements for the scheme based on other examples.

Section 5 outlines initial thoughts on the Commercial Case and Management Case for the scheme. Developing these cases is not part of the commission of work undertaken so far, but this section summarises the questions BBC will need to consider as the SOBC is developed further. This includes the procurement strategy, risk allocation and transfer, contract and implementation timescales, governance structure, communications and stakeholder management.

Section 6 summarises the business case presented through the report and recommends next stages that should be undertaken.

2. The Strategic Case

2.1 Scheme Location and Definition

Broxbourne Borough is currently served by five stations, but there is not one in the area which serves Turnford, which is located between Cheshunt to the south and Broxbourne to the north. The residential areas of Turnford and Wormley are located on the north-south A1170, with the A10 dual carriageway to the west and the West Anglia Mainline acting as a barrier to the east. Figure 2 shows the location of Turnford. To the east of the railway line is the Lee Valley Regional Park, a predominantly wetlands area with restrictions on development.

To the west of the A10 at the south end of Turnford is a large retail development called the Brookfield Centre, located along both sides of Halfhide Lane.
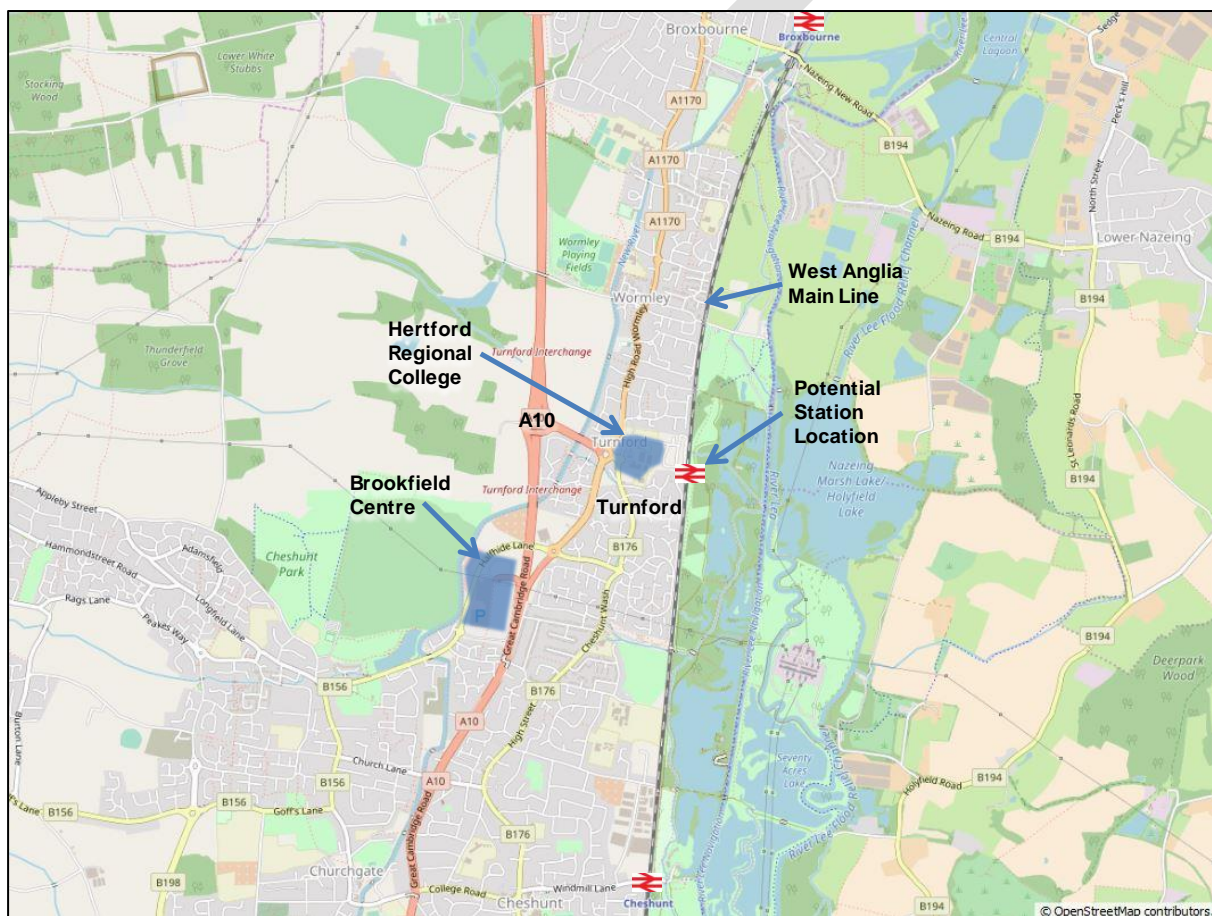
Figure 2: Location of Turnford

Given the proximity of Hertford Regional College, the proposed expansion of the Brookfield Centre and proposed housing development at Brookfield (expanded on in section 2.4), a new station has been proposed at Turnford, which lies approximately equidistant between Broxbourne and Cheshunt on the West Anglia Main Line.

This lies within the A10/M11 corridor which is identified as one of the major transport corridors in Hertfordshire's Strategic Economic Plan. This scheme would provide rail access to a range of current and future attractors in the local area, including Hertford Regional College.

The site identified for a potential station at Turnford and tested as part of this report is located close to Hertford Regional College in the centre of Turnford. The station would provide access to this site

for students from Cheshunt, Broxbourne and beyond, as well as providing access from the local residential areas to rail services to London and Cambridge in particular.

BBC provided a detailed drawing of the access arrangements for the station, and potential location of entrances, which is shown in Figure 3. The main access road is to the south side of the college where a private staff road / car park for the college already exists. This would continue on through current waste land between housing developments through to the main station entrance at the north end of the station. The access road would allow for drop off and bus stops only, no parking provision is planned or considered in the business case. An additional entrance at the south end of the station, from Landau Way is also assumed. This would give pedestrian access from the local housing estate and be a closer access from the existing bus stops on the High Road in this location.

Figure 3: Location and Access Plan for Turnford Station

2.2   Context of Turnford in the Rail Network

The proposed location of the new station at Turnford is on a currently two-track section of line. All passenger services through the location are currently operated by Abellio Greater Anglia, with a mix of faster 'outer' services from London Liverpool Street to Stansted Airport (Stansted Express), Cambridge and Kings Lynn, 'inner' stopping services between Hertford East and London Liverpool Street / Stratford, as well as semi fast services between Bishop's Stortford and Stratford.

South of Turnford is Cheshunt station, where the route splits, with most services continuing south via Tottenham Hale to London Liverpool Street and Stratford. There is also the route west of this via

Seven Sisters, to London Liverpool Street. TfL-specified London Overground services operate southbound from Cheshunt to London Liverpool Street via Seven Sisters, calling all stations.

At present, there is little capacity available on the two-track line. However, analysis of the timetable using NR timetable planning rules shows that, with a stop at Turnford, a workable solution can be provided, with a few assumptions around slight adjustments to timings and where trains lay over. This full analysis is provided in a separate Technical Note[2]. In the 'with CR2 scenario', the CR2 project would provide an additional two tracks in this location, from Broxbourne to Coppermill Junction to the south of Tottenham Hale. This would allow fast services to run on two new dedicated tracks laid to the east of the current two tracks. The existing two tracks would then be used solely by the slower stopping services – the existing two trains per hour Hertford East to Stratford service and the proposed 12tph CR2 services from Broxbourne, through Central London to Southwest London. This scheme is not currently committed / funded, but is well developed and has a current planned opening year of 2033.

It is assumed that platforms would be provided on the two existing tracks (that become the 'slow' tracks in the 'with CR2 scenario', and allow the CR2 and Hertford East to Stratford services to stop at Turnford. These would provide rail connectivity within the West Anglia corridor and direct services to Central and South West London.

The business cases presented in this report are based on the above assumptions, with the assumed opening year for the station being 2033 in all scenarios for consistency. Figure 4 shows the CR2 route.

2.3   Expected Benefits

The potential benefits of a new station at Turnford are summarised below:

- Serve potential major mixed-use development as well as existing land uses;
- Reduce access/ egress time to key attractors in the area e.g. Hertford Regional College;
- Could improve house values in the area between Broxbourne and Cheshunt;
- Could reduce throughput at Broxbourne and Cheshunt stations and potentially alleviate access concerns at Broxbourne Station; and
- Provide additional local connectivity and a linkage to central London.

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[2] "Turnford Timetable Analysis Technical Note", AECOM
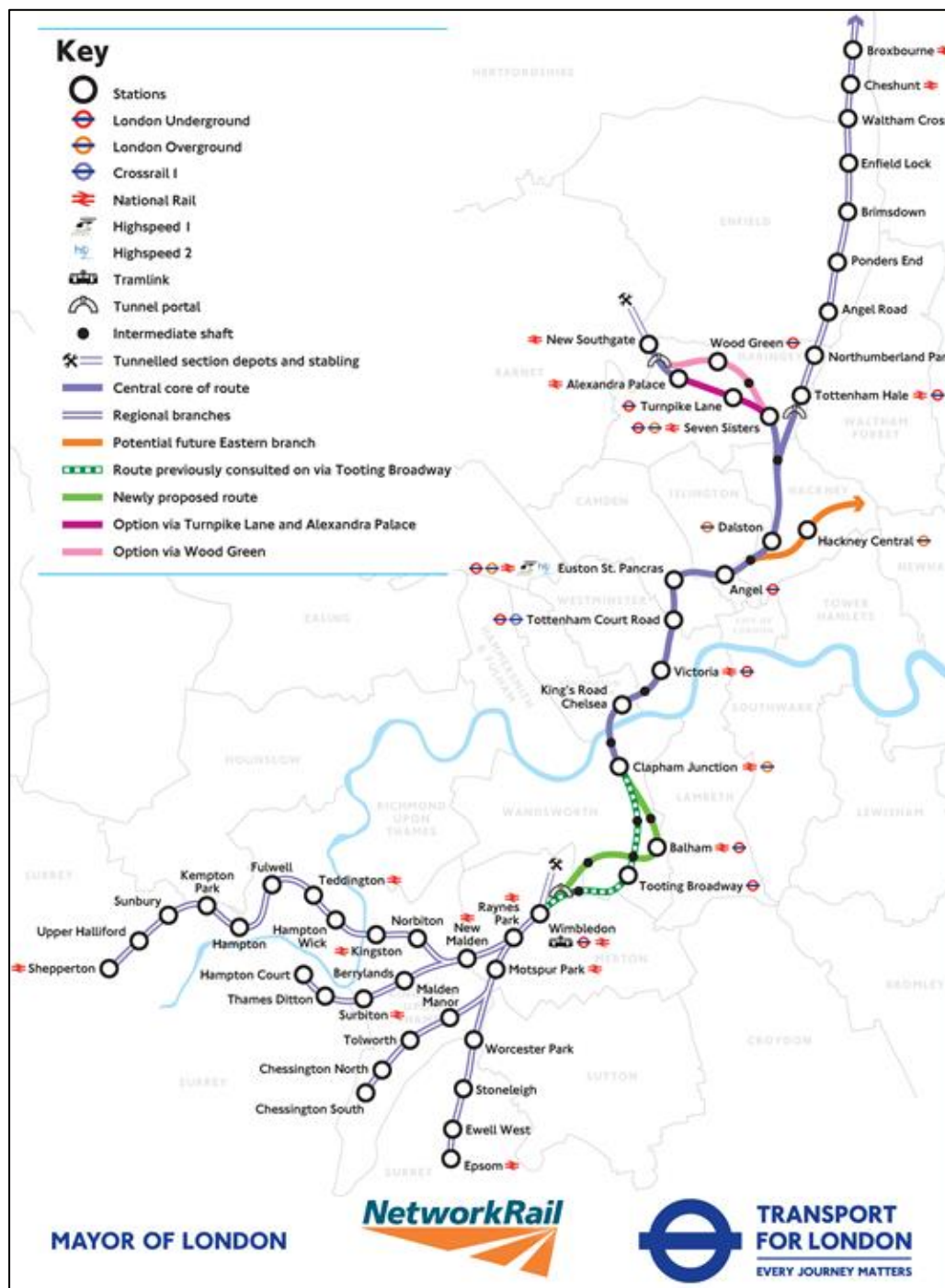
Figure 4: Crossrail 2 Scheme (as of October 2015)

2.4   Population and Employment Growth

Hertfordshire Transport Vision[3], and the Draft Hertfordshire Local Transport Plan[4] published November 2017, provide details of the wider population and employment across the county. These contain broadly similar data and forecasts, and the information from the Transport Vision are presented here whilst the Hertfordshire Local Transport Plan is still in draft.

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[3] Hertfordshire 2050: Transport Vision Stage 2, Technical Report, Steer Davies Gleave, September 2015
[4] https://www.hertfordshire.gov.uk/media-library/documents/about-the-council/consultations/ltp4-local-transport-plan-draft.pdf

Table 2-1 highlights the forecast growth for Broxbourne in comparison with that for Hertfordshire as a whole. This shows that population in Broxbourne is predicted to grow by a slightly lower percentage than Hertfordshire as a whole, whereas jobs are predicted to grow by a slightly higher percentage than the county.

Table 2-1: Population and Employment Growth in Broxbourne and Hertfordshire, 2014 – 2031

	Hertfordshire (All)	Broxbourne
Population 2014	1,150,800	95,800
Population 2031	1,303,200	107,900
Growth Absolute	152,400	12,100
Growth Percentage	13.2%	12.6%
Employment 2014	640,870	49,100
Employment 2031	717,000	55,900
Growth Absolute	76,130	6,800
Growth Percentage	11.9%	13.8%

Table 2-2 shows the population and employment within a 2 km catchment[5] of a proposed location of the new station, with equivalent data for Broxbourne and Cheshunt included for reference, from the DfT's Tempro Forecasts. It should be noted that the 2 km catchment for the new station overlaps the catchments of Broxbourne and Cheshunt, as shown in Figure 5, and therefore it is likely that there will be some abstraction of demand from either or both of the existing stations if a new station is implemented.

Table 2-2: Population and Employment Growth within a 2 km Catchment

	Turnford	Cheshunt	Broxbourne
Population <2km 2015	27,508	20,393	22,864
Population Growth to 2030 <2 km	4.69%	4.58%	4.63%
Workers <2km 2015	13,672	17,105	11,717
Workers Growth to 2030 <2 km	-3.07%	-3.18%	-3.07%

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[5] 2 km is generally considered as the maximum distance people will walk to access to public transport services. For example in the DfT Transport Connectivity Travel Time Indicators:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/435911/connectivity-statistics-guidance-notes.pdf
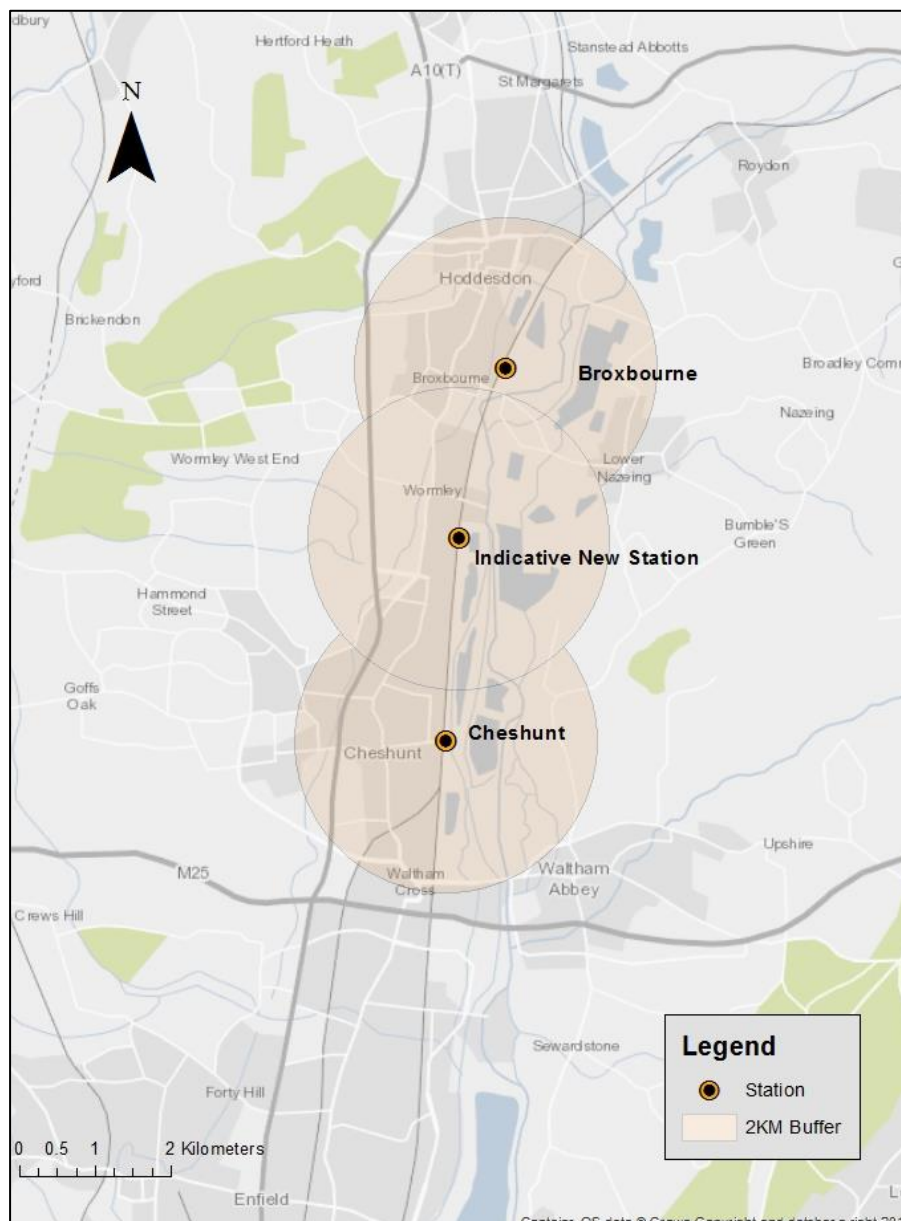
Figure 5: 2km Catchment Areas for the Potential New Station, Broxbourne and Cheshunt

2.5   Development Plans in the Turnford Area

Along with the existing settlement at Turnford described above, there are notable development plans for the area. The full modelling and forecasting process is covered is Section 3, but highlighted here within the context of Turnford station are the large Brookfield Riverside and Brookfield Garden Village developments to the west of the A10, which are included in the Draft Local Plan[6]. These comprise:

- **Brookfield Riverside:** Extending Brookfield northwards up to and beyond the Turnford junction on the A10. It will include modern shopping and leisure facilities including a department store, cinema, cafes and restaurants, and feature a civic centre, a business campus, health centre, bus station, and about 250 apartments and elderly people's accommodation within a mixed use and green environment.

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[6] http://consult.broxbourne.gov.uk/portal/planning/reg19/reg19?pointId=4653994

- **Brookfield Garden Village:** including 1,250 homes north and west of Brookfield Riverside, comprising walkable neighbourhoods and one or more new primary schools, linked by a tree-lined boulevard;

An indicative concept plan for these developments is shown in Figure 6, which is taken from the Draft Local Plan[7]. Direct walk and cycle access to the Hertford Regional College and potential location of the new station are considered within the scheme, and Turnford would be the closest railways station to these developments.
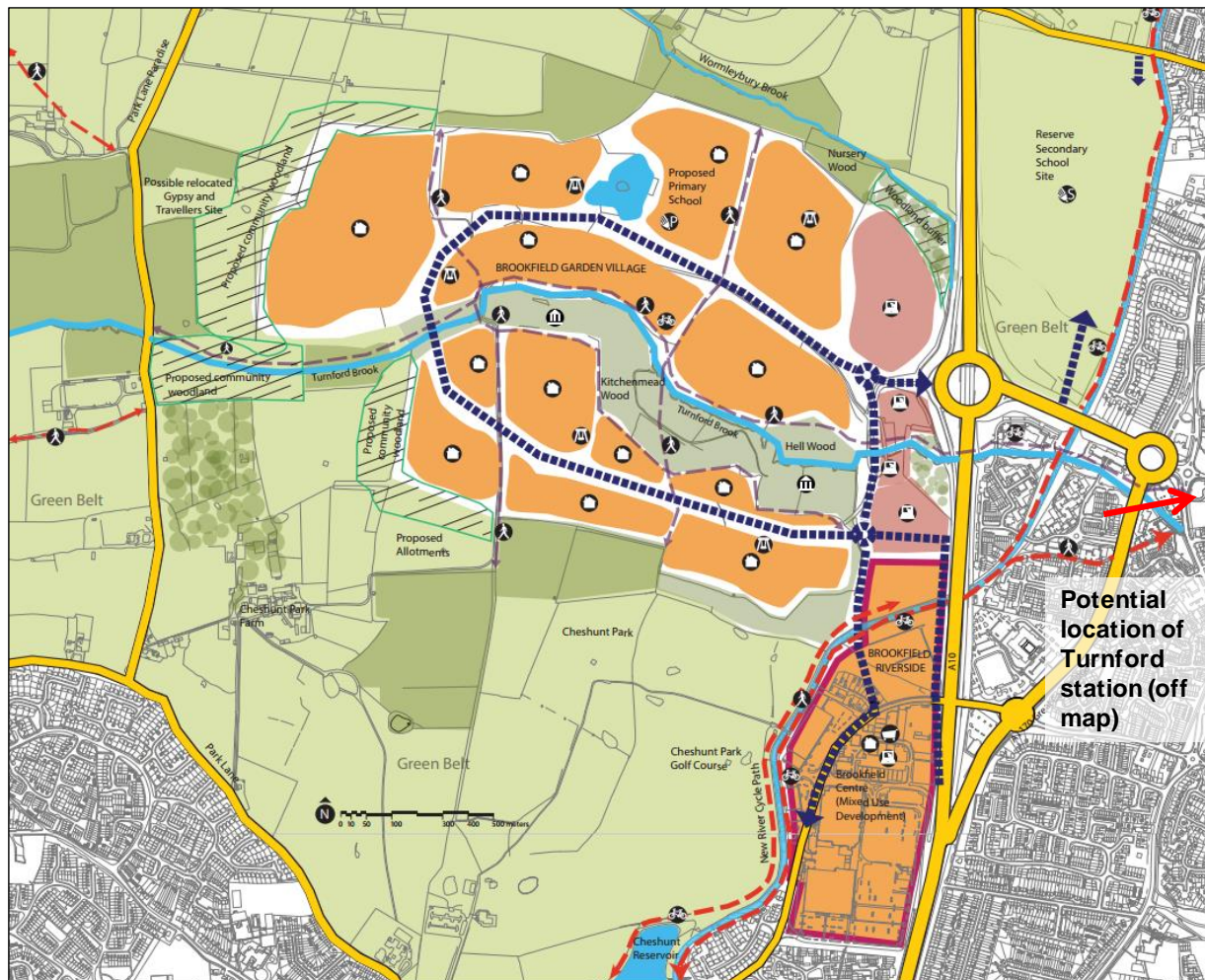
Figure 6: Concept Plan for Brookfield Riverside and Brookfield Garden Village Developments

© Broxbourne Borough Council Draft Local Plan

2.6   Policy Context

In Hertfordshire's Transport Vision[8] the A10/M11 corridor (with the West Anglia route) is identified as a major transport corridor, particularly in relation to harnessing relationships with London. The vision identifies a number of schemes which have been assessed in relation to achieving wider objectives. Of relevance to Turnford station are increased frequency of services in the Lea Valley on the West Anglia Main Line, and four-tracking of the West Anglia Main Line. These are identified as contributing to strategic objectives to protect and increase capacity and connectivity, to improve journey times and provide sufficient transport capacity to support new development and related travel.

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[7] http://consult.broxbourne.gov.uk/portal/planning/reg19/reg19?pointId=4653994
[8] Hertfordshire County Council: Hertfordshire's 2050 Transport Vision Stage 2: Technical Report, Steer Davies Gleave, September 2015

The draft Hertfordshire Local Transport Plan 2017[9] identifies Turnford station as a new station location to investigate, and outlines that HSS is working with BBC and NR to examine the feasibility of the station.

Hertford's Rail Strategy[10] has identified development objectives for the West Anglia Main Line, which are supporting competitiveness; enabling economic growth; supporting the environment and sustainability; and supporting population growth. The conditional outputs that this resulted in related to addressing existing capacity constraints, adding additional capacity to accommodate future demand between local growth areas and for London-based demand. Specific interventions include four tracking of the West Anglia Main Line and Crossrail 2.

The Broxbourne Local Plan[11] highlights the vision and objectives for the borough between 2016 and 2031. The Borough anticipates the strengthening of the local economy through the provision of additional job opportunities throughout the Borough, particularly high-value jobs proposed at Brookfield, Park Plaza North and Park Plaza West.

It is recognised that future development will generate additional trips on the local transport system. One of the objectives of Broxbourne therefore is that the growth and regeneration can be accommodated on local highway links, the A10 corridor and the West Anglia rail corridor. The objectives include the encouragement of as many travellers as possible to use more sustainable modes such as rail, bus, walk and cycle, and the Borough is supportive of the CR2 proposals. Therefore, the implementation of a new station at Turnford conforms to local policy through additional transport provision to support growth and regeneration at Brookfield, as well as an alternative mode of transport to support existing and future land attractors in the local area.

2.7   Travel Patterns

Anecdotal evidence suggests that there is high demand for travel to key attractors in the area, such as Hertfordshire Regional College. Such demand currently uses Broxbourne or Cheshunt stations, and access destinations via foot or bus.

Proposed major mixed-use development at Brookfield Riverside is outlined in the Broxbourne Local Plan. Again, there is currently no evidence of the travel patterns for users of the new development, but the magnitude of the proposals and the fact that much of the site falls within a 2 km catchment of the proposed location of a new station suggests that a new station could help to support and accommodate some of the development demand.

2.8   Opportunities and Constraints

Table 2-3 presents a summary of the opportunities and constraints relating to a new station at Turnford.

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[9] https://www.hertfordshire.gov.uk/media-library/documents/about-the-council/consultations/ltp4-local-transport-plan-draft.pdf
[10] Hertfordshire Rail Strategy, Arup, April 2015
[11] Broxbourne Local Plan: A Framework for the Future Development of the Borough, October 2015

Table 2-3: Opportunities and Constraints Analysis for Proposed Turnford Station

Opportunities	Constraints
• Serve potential major mixed-use development as well as existing land uses • Reduces access/egress time to key attractors in the area e.g. Hertfordshire Regional College • Could improve house values in the area between Broxbourne and Cheshunt • Could reduce throughput at Broxbourne and Cheshunt stations and potentially alleviate access concerns at Broxbourne Station.	• Capacity on existing two-track railway for new station – potential performance impacts • Reliance on CR2/ 4- tracking of Lea Valley for significant capacity release • Adds additional journey time to users of existing services from Broxbourne due to extra stop • Catchment area of 2 km overlaps with that of both Broxbourne and Cheshunt • Proximity of residential areas to the existing double track • Access through residential areas not suitable for large volumes of passengers and residential on-street parking evident • Likely to have residential opposition • Lack of space for rail user parking • Station location not on direct pedestrian and cycle routes • Already a good level of bus provision between other stations in the corridor to the main attractors

2.9   Stakeholders

The following stakeholders have been identified at this stage of the project. This list and the roles, responsibilities and contributions should be kept up to date as the project progresses. Any potential conflicts should be identified, to allow early engagement of associated parties.

Stakeholder	Role
Broxbourne Borough Council	Promoter of the Scheme
Network Rail (including joint Crossrail 2 team with TfL)	Anticipated to own the station and be responsible for incorporating the station into the existing network
Transport for London (including joint Crossrail 2 team with NR)	Anticipated to become the Station Facility Owner and responsible for most services from the station in the 'with CR2' scenario. In 'without CR2' scenario still have interaction with London Overground services to Cheshunt
Hertfordshire County Council	Supporting BBC with development of the scheme. Scheme fits with HCC transport plan objectives
Department for Transport	Responsible for overall national rail strategy
Office of Rail and Road	Rail Regulator which has responsibility for issuing licences to operate stations and trains
Abellio Greater Anglia	Current operator of rail services through the area and potentially operator of services which could call at Turnford. Anticipated to become the Station Facility Owner in the 'without CR2' scenario.
Hertford Regional College	Owner of land required as part of the current plan for access to the station
Local Residents	Impacted by changes in local traffic flow and access arrangements, noise and construction activity

3. The Economic Case

3.1　Introduction & Approach

Because there is currently no rail station, then the use of standard rail demand forecasting tools such as MOIRA was not possible in this case. MOIRA is an incremental elasticity-based model, which relies on an existing level of demand and then forecasts the resultant change in demand of relatively small changes to service provision.

DfT provides guidance on how to forecast demand for new rail stations[12], starting with a trip rate approach at the simplest level and then through more complex gravity models to a full four stage model.

An existing four stage multi-model model (COMET) covering the area already exists, which contains both public transport and highway demand to forecast the demand, mode shift, and time savings benefits and has therefore been used for this study. COMET is a strategic multi-modal model which covers all of Hertfordshire and is a readily available tool which allows the assessment of the impacts of a new station. It has been developed by AECOM on behalf of Hertfordshire County Council (HCC). Local councils within Hertfordshire are able to use the model as they have provided information to aid its development, such as development plans, scheme information and observed data.
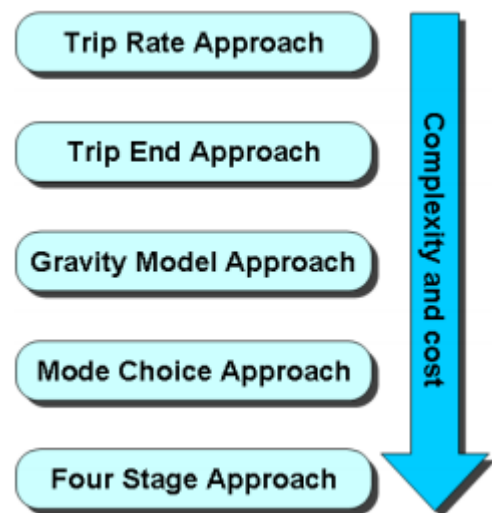
COMET has been developed as a strategic countywide model and has not been developed specifically to represent conditions in urban areas. The model's main purpose is to simulate inter-urban movements in Hertfordshire, and the calibration/validation process has been conducted accordingly.

Population and employment growth from the model's Base Year (2014) to future years for Hertfordshire uses HCC Local Plan growth forecasts. Outside of Hertfordshire the Department for Transport (DfT)'s National Trip End Model (NTEM) v7.2 forecasts are used.

For the Turnford area, this results in the population growth from 2014 to 2031 (the model forecast year used for the modelling) shown in Figure 7, whilst the equivalent employment growth forecast is shown in Figure 8.

The impact of the Brookfield development sites to the west of the A10 but close to the potential Turnford station site can be clearly seen, with limited change expected elsewhere in the 2km catchment.

Also notable is the significant reduction in employment close to Cheshunt station, particularly due to the closure of the Tesco head office in this location, and the resultant increase in population due to plans for residential development in this area.

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[12] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3978/guidance-note.pdf
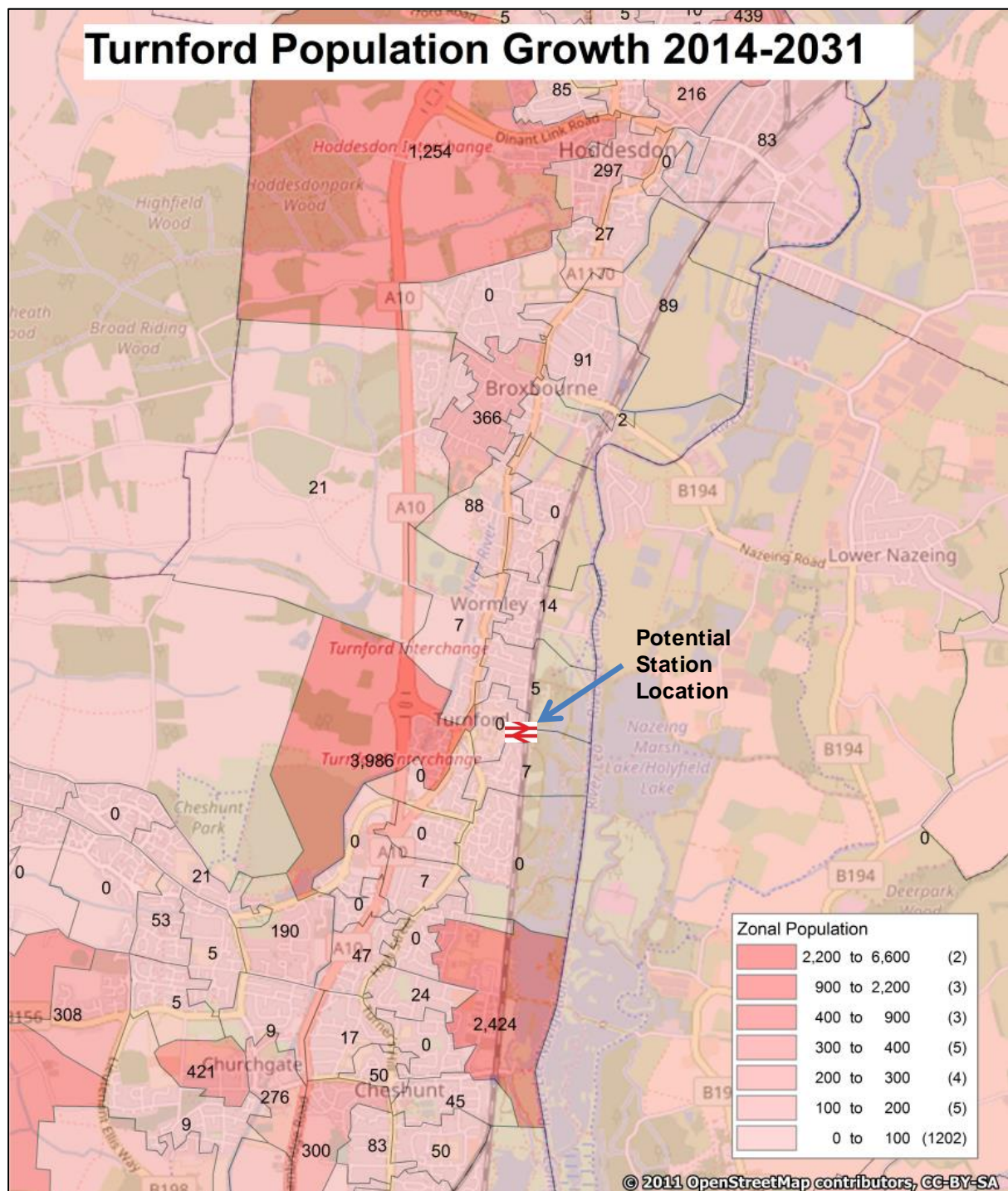
Figure 7: COMET Population Growth Forecast 2014 to 2031
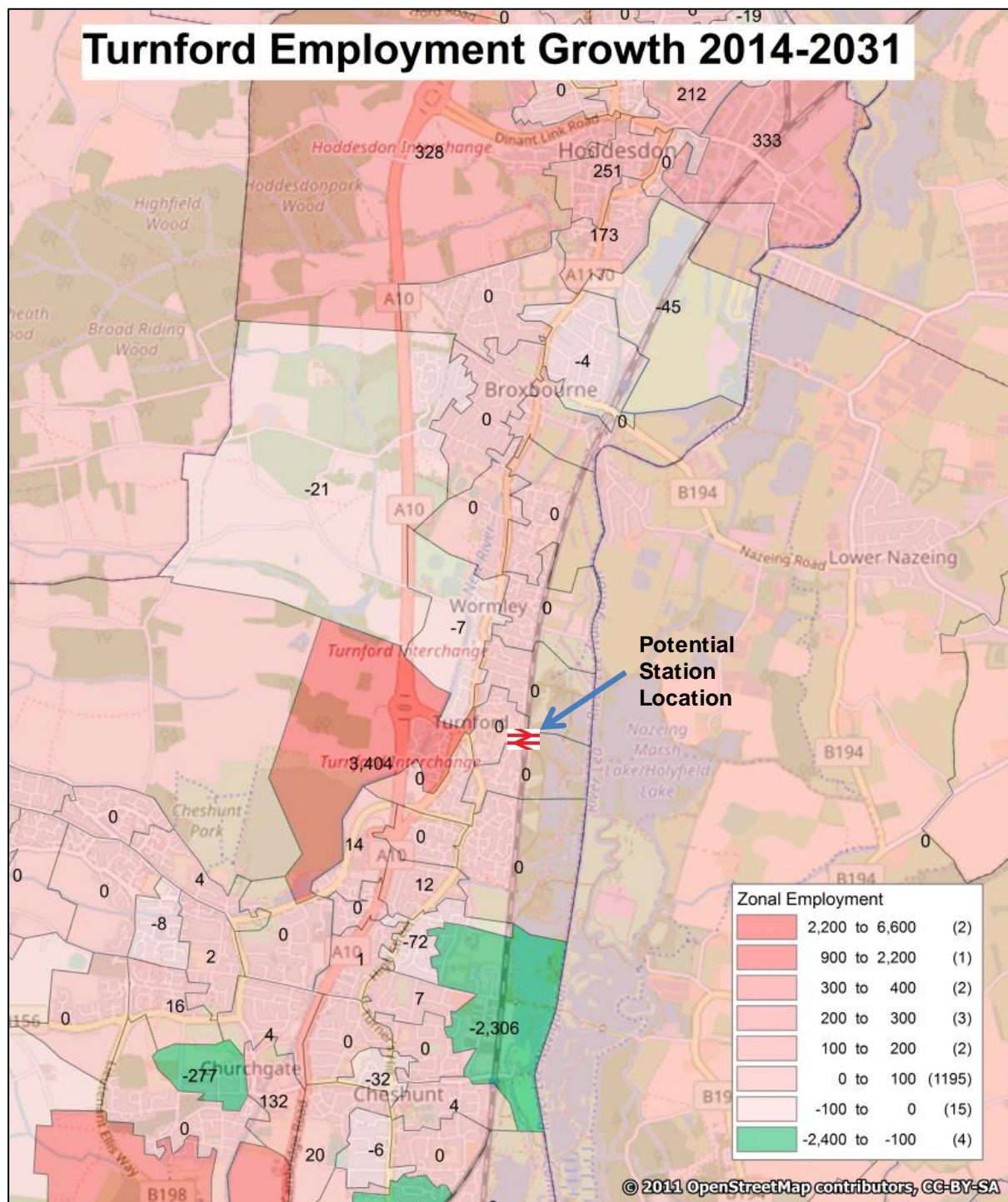
Figure 8: COMET Employment Growth Forecast 2014 to 2031

3.2   COMET Modelling

The COMET model has been developed by AECOM on behalf of HCC. It has been updated and enhanced a number of times. At the time of the initial 'with CR2' scenario (2018), the most up to date version of the model available was used, which was 'version 2'. It has a Base Year of 2014 and a single test of the scheme using the 2031 forecast year has been used, as this is the furthest forward forecast year available for that version and is close to the assumed opening year of 2033. The model has separate Morning Peak, Inter Peak and Evening Peak scenarios, from which outputs are factored up to cover the whole day, and then up to annual. Subsequent tests in 2020 of the 'without CR2'

scenario have also been undertaken using this version of the model, to main consistency between results.

The remaining text in Section 3.2 to Section 3.15 relates to the original 'with CR2' scenario modelling, using TAG and PDFH guidance which was current at that time (2018). The tests undertaken in 2020 update TAG and PDFH guidance to the latest versions, and also test the business case in the 'without CR2', and these are all summarised in Section 3.16 onwards. The first part of Chapter 3 relates to the original work, termed the Core scenario.

Outputs from the 2031 model scenario have been growthed to 2033 using the DfT TAG general population growth forecast. A full summary of TAG, the assumptions and guidance used is contained in section 3.3.

The model coding in the Turnford area was reviewed, with particular focus on the future year rail service coding through Broxbourne/Cheshunt, as well as the walk network and connections around the station, as shown in Figure 9. The rail coding was reviewed with the joint NR and TfL CR2 team and updated accordingly with their input. The rail coding assumed is summarised in Table 3-1. All services are assumed to be all day (7am - 7pm) in both directions.

In the 'Do Minimum' scenario against which the 'with station' test is compared, all services are coded as non-stop at Turnford, whilst in the 'with station' scenario only those noted in the table stop at Turnford. In the 'with station' scenario an extra two minutes journey time is added between Cheshunt and Broxbourne to account for the additional stop at Turnford, allowing the time for the train to slow down, open and close the doors to allow passengers to board and slight, and then accelerate away again. This time is in line with existing stops on metro-style rail services. The journey times between Cheshunt and Broxbourne are summarised in Table 3-2.

Table 3-1: Assumed Future Rail Service Coding Through the Turnford Area

From	To	Trains Per Hour	Relevant Calling Points	Notes
Broxbourne	South West London	12	All stations via Tottenham Hale	Crossrail 2 service. Assumed calls at Turnford.
Hertford East	Stratford	2	All stations via Tottenham Hale	Assumed calls at Turnford.
Stansted	Liverpool Street	4	Tottenham Hale	
Cambridge North	Liverpool Street	2	Broxbourne, Cheshunt, Tottenham Hale	
Cambridge	Liverpool Street	1	Tottenham Hale	Peak Period direction only (up in the AM, down in the PM)
Kings Lynn	Liverpool Street	1	Tottenham Hale	Peak Period direction only (up in the AM, down in the PM)
Hertford East	Liverpool Street	2	Cheshunt, Tottenham Hale	
Bishop's Stortford	Stratford	2	Broxbourne, Cheshunt, Tottenham Hale	

Table 3-2: Journey Time Between Cheshunt and Broxbourne with and without Turnford Stop

From	To	Direction	No Turnford Stop	With Turnford Stop
Broxbourne	Cheshunt	Up	3.5min	5.5min (2.75min Broxbourne to Turnford, 2.75min Turnford to Cheshunt)
Cheshunt	Broxbourne	Down	4min	6min (3min Cheshunt to Turnford, 3min Turnford to Broxbourne)

In the 'with station' scenario, the public transport network was modified to include the station on the rail link between Broxbourne and Cheshunt, station entrances at the north and south of the station were added, and the walk links/connections to the High Road / Landau Way were added. The network as coded in the model is shown in Figure 9. Those links in green are the links only in the 'with station' scenario. Node 101250 represents the access point to the station from the north whilst node 115003 is the access point from Landau Way.
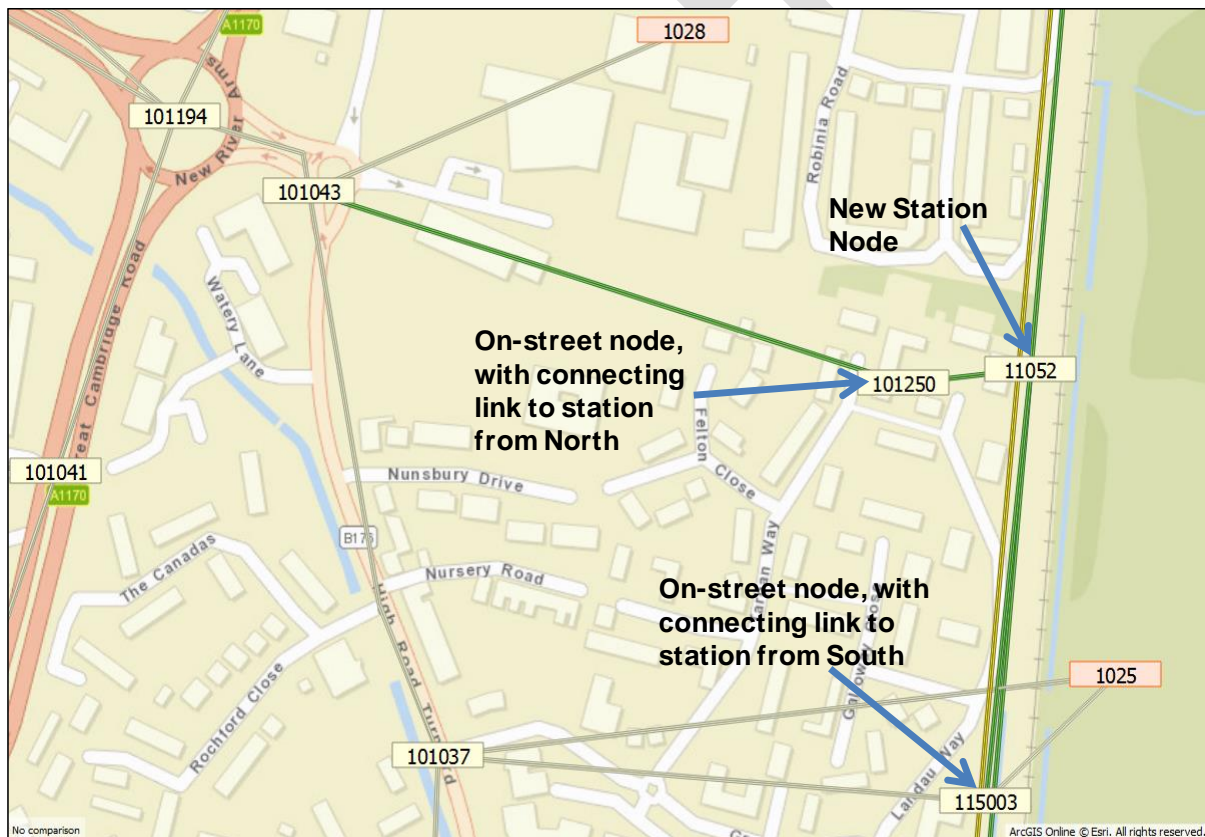
Figure 9: COMET 'without Station' and 'with Station' Network Coding

As well as the rail service coding changes already described, there is an additional bus service in the future relevant to Turnford station which is part of the Broxbourne Transport Strategy. This is included in both the 'without station' and 'with station' scenarios and runs from Waltham Cross, via Cheshunt Station and the existing Brookfield development, through the new Brookfield developments to Turnford. This is to support the Brookfield developments previously described and will give access to the rail stations in the area.

In the 'without station' scenario this is assumed to terminate in front of Hertford Regional College on the A1170, whilst in the 'with station' scenario it is assumed to extended to serve the station forecourt bus stop area, represented by node 101250 in Figure 9.

Figure 10 shows the new bus route in the 'without station' scenario. It is assumed to run every 15 minutes in both directions throughout the modelled time periods (7am to 7pm).
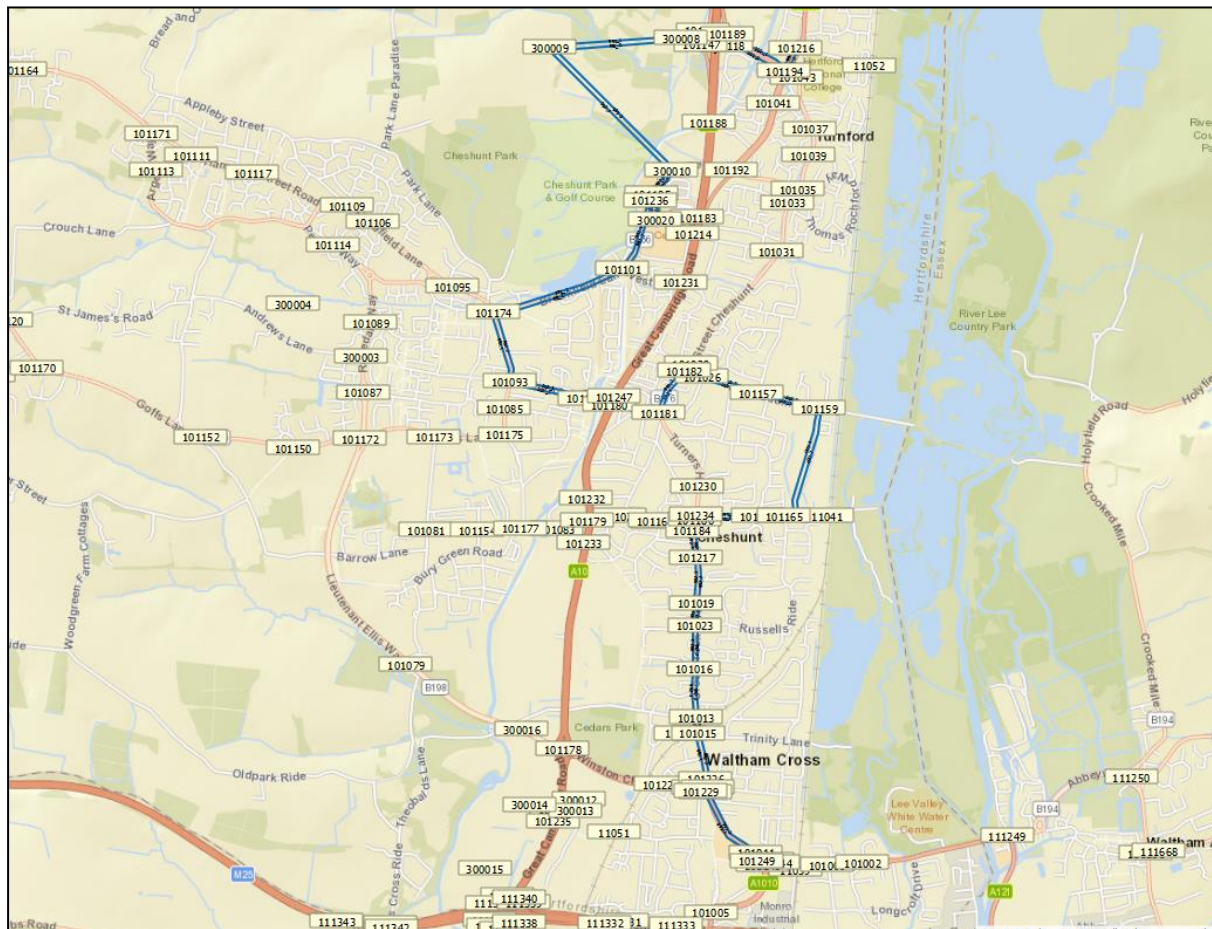
Figure 10: New Bus Route from Waltham Cross to Turnford via Brookfield Development

However, the version of the model used creates separated bus and rail demand matrices during the trip generation and modal split elements of the model run, and these are 'fixed' to only using the single mode, either bus or rail. No multi-mode bus-rail trips are allowed. A rail trip from Turnford to London for example would have to access the station via walk when in reality bus access may be more attractive. This means that, in the model, the new bus route does not provide access to Turnford station from the Brookfield developments as may be expected.

Overall generalised time cost in the model will be broadly similar, however. Walk time attracts a 'weighting' of 2 (as per TAG Unit A1.3, Section 4.4 guidance) to reflect people's adversity to walk compared to in-vehicle travelling time. However, for bus there is a boarding penalty, bus cost, walk time (plus weighting as above) and wait time (which is also weighted by 2) so the resultant generalised cost for trips from Brookfield to Turnford will be broadly equivalent.

Therefore, trips can only access Turnford station by walking rather than using bus, but this is possible from all areas in the model. This is considered a conservative estimate of the potential demand for the station.

3.3   Assumptions – TAG

The DfT's TAG guidance sets out a range of methodologies, forecasts and assumptions that should be used in the conduct of transport appraisals. This business case for Turnford presented in this report has been built using that guidance as of November 2017 when the study was undertaken. Subsequent updates of the business case for both the 'with CR2' and 'without CR2' using the latest

TAG guidance are covered in Section 3.16. Table 3-3 lists the TAG document dates used for the Business Case, which were the most up to data versions at the time. A range of assumptions have been made, taken from that guidance along with other data and information on the project (such as opening years) which are summarised here.

Table 3-3: TAG Document Versions Applied

Databook	July 2017
Unit A1.1 Cost Benefit Analysis	November 2014
Unit A1.2 Cost Estimation	July 2017
Unit A1.3 User and Provider Impacts	March 2017
Unit A5.3 Rail Appraisal	July 2017
Unit M4 Forecasting and Uncertainty	July 2017

Assumed Years

A range of years need to be defined as part of the business case, from which other assumptions pivot from (such as discounting, pricing of costs, etc.). These are defined in Table 3-4.

Table 3-4: Years Assumed in the Appraisal

TAG Price Base	2010
Appraisal Year	2017
Construction Start Year	2030
Construction Complete Year	2032
Opening Year	2033
End of Appraisal Year	2092

The opening year is assumed to be 2033, which is the current target opening year for CR2. Due to the very early stage of this assessment it has simply been assumed that operations start in early January and 2033 is a full year of operation.

Construction is assumed to take place over a three-year period from 2030 to 2032, again with a simple indicative phasing of 25% spend in 2030, 50% spend in 2031 and 25% spend in 2032 for business case purposes.

TAG requires that a 60-year appraisal period for annual costs and benefits of the scheme is used (TAG Unit A1.1, Section 2.3), with 2033 being year 1 and 2092 being year 60.

All of the business case processing has been undertaken on a calendar year basis. Where inputs are in a different format, this has been converted to calendar years. For example, some growth rates in TAG are in financial years, and these have been converted by taking 25% of the first year rate and 75% of the second year rate, as outlined below:

- TAG Databook A5.3.1, RPI annual growth 2010/11: 4.96%
- TAG Databook A5.3.1, RPI annual growth 2011/12: 4.80%
- Calculated RPI annual growth for 2011: 0.25*4.96 + 0.75*4.80 = 4.84%

Price Base

The DfT uses a single price Base Year of 2010, from which all costs and benefits should be converted, to allow consistent comparison across schemes. Nominal costs in the future are adjusted to 'real' costs using the TAG GDP deflator index, from the July 2017 TAG Databook (the most up to date available at the time of the analysis).

Discounting

In addition, values should also be discounted to the 2010 Base Year, which is different to the conversion of prices as above to account for inflation. TAG Unit A1.1, Section 2.7 describes this as:

There is evidence to show that people prefer to consume goods and services now, rather than in the future. In general, even after adjusting for inflation, people would prefer to have £1 now, rather than £1 in 60 years' time.

Accounting for this is called discounting and the TAG guidance rates from the July 2017 TAG Databook have been applied as per Table 3-5. In addition, the guidance states that 3.5% discount rate should be applied for years between the DfT price Base Year (2010) and the current year (2017).

Table 3-5: TAG Discount Rates Applied

Years from Current Year		Discount Rate	Years Applies to
From	To		
0	30	3.50%	2017 to 2047
31	75	3.00%	2048 to 2092
76	125	2.50%	N/A
126	200	2.00%	N/A
201	300	1.50%	N/A
301	301	1.00%	N/A

Source: TAG Databook (July 2017), Table A1.1.1

Market Prices

All values of cost and benefits have been converted to Market Prices where appropriate as recommended in TAG (Unit A1.1, Section 2.5), by applying a 1.19 indirect tax correction factor.

Optimism Bias

Optimism Bias has been applied to Capital and Operating Costs as per TAG (Units A1.2, Section 3.5 and A5.3, Section 2.5) at the Level 1 Project Definition stage. This adds 64% to Capital Costs and 41% to Operating Costs assumed in the business case, as shown in Table 3-6.

Table 3-6: TAG Optimism Bias Adjustments to Costs

Project Development Level (Equivalent to Network Rail GRIP Stage)	Level 1	Level 2	Level 3	Level 4	Level 5
Activity	Project Definition	Pre-feasibility	Option Selection	Single Option Refinement	Design Development
Capital Expenditure					
QRA Required	NO	NO	QRA	QRA	QRA
Optimism Bias	64%	64%	18%	9%	4%
Operational Expenditure					
QRA Required	NO	NO	NO	QRA	QRA
Optimism Bias	41.0%	1.6%	1.0%	1.0%	1.0%
(How Applied)	(to PVC)	(per annum)	(per annum)	(per annum)	(per annum)

Source: TAG Unit A5.3 (July 2017), Table 3

Demand Growth

As noted in section 3.1 and section 3.2, a single forecast of demand and benefits for 2031 has been undertaken using the COMET model. This accounts for changes in population and employment at a zonal level across the modelled area, based on NTEM v7.2 forecasts (As recommended in TAG Unit M4, Section 3.2) outside of Hertfordshire and HCC Local Plan data for Hertfordshire.

Model outputs for the 2031 scenario have been growthed to 2033 using the general population forecast in the TAG (July 2017) Databook, to create the forecast opening year data. Demand and benefits have then been extrapolated forward, again using the general population forecast, up until 2037, the demand cap year.

TAG Unit A5.3 (July 2017) recommends that demand growth is capped 20 years after the appraisal year (Section 2.3) and this forms our core forecast. However, Unit A5.3 also recommends sensitivities are undertaken on this assumption. Furthermore, the forthcoming changes to this unit had been published at this time and the revised December 2017 version of Unit A5.3 recommends that demand is extrapolated forward for the entire 60 year appraisal (subject to a review of available capacity/crowding on the service) using the general population forecast in the TAG Databook, and so a sensitivity test has been undertaken using this assumption.

Values of Time (VoT)

Demand has been segmented in the business case analysis based on the COMET purpose splits outlined in section 3.4. This allows different VoT to be applied to the different user groups, to calculate a more accurate estimate of journey time benefits.

TAG guidance has changed in Unit A1.3 (March 2017) compared to previous versions, on the application of VoT to user benefits, with evidence showing that Employers Business VoT changes with distance travelled. A continuous function is provided (Unit A1.3, Section 4.2) to allow VoT to be calculated for each user based on their distance travelled. However, for this early stage study, and given the vast majority of Employers Business users of the station will be undertaking journeys of a similar length from Turnford to Central London, we have applied the 'distance banded' average rail passenger VoT for journeys of 0-50km in the TAG (July 2017) Databook.

The TAG (July 2017) Databook also provides the VoT for commuting and other purposes, and all of the VoTs used to calculate journey time benefits are shown in Table 3-7.

Table 3-7: TAG Values of Time by Trip Purpose Relevant to Rail Passengers

Trip Purpose	£ per hour, 2010 prices, 2010 values, Market Price
Employers Business, Rail Passenger 0-50km	10.02
Commuting	9.95
Other	4.54

Source: Adapted from TAG Databook (July 2017), Table A1.3.1

3.4   Assumptions – Other

Construction Cost Inflation

Whilst all costs are converted to the 2010 Base Year, any real cost changes over time which occur above or below DfT's measurement of inflation, the GDP Deflator, should be taken into account (TAG Unit A1.2, Section 2.2).

There is evidence that construction costs (capital cost) and maintenance / renewals costs can change at a different rate to general inflation, and this should be taken into account in the estimation of these costs.

The Office of National Statistics (ONS) has published Construction Output Price Indices[13] since 2014, and prior to this they were published by the Government Department for Business, Innovation and Skills (BIS)[14].

These two datasets are indexed to different years, but it is possible to create a linking factor during the overlap period in 2014, to create a continuous comparison. Table 3-8 shows the annual change in construction cost inflation for 'All New Work' derived from these two sources, alongside the GDP Deflator.

As can be seen, although the impact of the recession saw lower construction costs through 2010 and 2011, during more recent stable years construction cost has grown generally 1-2% faster than inflation. This has shown signs of falling again in 2016 and early 2017.

An assumption that Construction Cost Inflation is 1% higher than general inflation has been applied from every year from 2010 throughout the full appraisal period to 2092.

Table 3-8: Construction Cost Inflation Compared to TAG GDP Deflator, 2010 - 2016

Year	Construction Cost Inflation	GDP Deflator	Difference
2010	-4.10%	1.54%	-5.64%
2011	0.00%	2.01%	-2.01%
2012	3.28%	1.54%	1.74%
2013	3.27%	1.91%	1.36%
2014	5.34%	1.65%	3.69%
2015	2.30%	0.55%	1.75%
2016	2.36%	1.73%	0.63%

Source: ONS Construction Cost Inflation[13], TAG Databook (July 2017), 'Annual Parameters' Table

Operating Cost Inflation

As with construction cost inflation, operating cost inflation above or below inflation as measured by the GDP Deflator should also be included in the analysis. Operating costs are covered in more detail in section 3.5, but are made up of two main elements; staff costs and maintenance / utilities charges.

Staff cost increases over time have been based on the TAG (July 2017) Databook real earnings index (worksheet A5.3.1) as recommended in TAG (Unit A5.3, Section 2.4.5), whilst non-staff costs such as the station Long Term Charge, utilities and maintenance have been increased using RPI from the same source.

Both of these increases have been forecast relative to the GDP Deflator change in each year.

Real Increase in Rail Fares

Rail revenue has been calculated for the 2031 forecast year from the COMET model, including assumptions within the model covering the forecast change in fare from the Base Year. Within the business case spreadsheet revenue is then forecast forward over the full 60-year appraisal period.

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[13] https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/interimconstructionoutputpriceindices
[14] https://www.gov.uk/government/collections/price-and-cost-indices

It has been assumed that rail revenue growth from fare increases is in line with inflation at the GDP Deflator rate, and the difference between RPI growth (which regulated rail fares are currently linked to) and GDP Deflator has not been applied. This is due to a number of reasons:

- It removes the requirement to forecast the reduction in rail demand as a result of rail fare increases, which would be expected (PDFH provides negative elasticities to fare increases);
- Not all fares increase in line with the regulated fares increases; and
- Not all users pay full fare, such as children, over 60s, railcard holders.

This is not compliant with DfT TAG guidance but is a conservative estimate of revenue as a result of the new station.

Demand lags

When new transport infrastructure is provided, the full demand takes a period of time to build as users become aware of the new opportunities and adjust their travel patterns. The PDFH produced by the Rail Delivery Group (RDG) summarises evidence of the demand lag from previously opened schemes. The current version (v5.1), Table B12.2 (Lags: Major New Services), provides the recommendations for the factors to apply to the first four years of forecast demand, to reflect this ramp-up in demand. This is summarised in Table 3-9 and has been applied in the business case.

Table 3-9: PDFH Recommended Demand Lags for Major New Rail Services

2033	2034	2035	2036
Average Year 1	Average Year 2	Average Year 3	Average Year 4
53%	78%	90%	100%

Source: PDFH v5.1, Table B12.2

Days per year

The COMET Model has been run for the Morning Peak, Inter Peak and Evening Peak periods, and produces demand forecasts for an average hour in each of these. The average hour is then factored up by 3 or 6, to give outputs for the full 12-hour 7am to 7pm period. The 12-hour demand/ benefits are then factored by 1.11 to cover the 7pm to 7am off-peak period, a factor which has been derived from the COMET demand matrices.

Weekday demand is then factored based on the assumed number of operating days per year in Table 3-10, to get annual demand, revenue and benefits. Saturdays and Bank Holidays assume the calculated 'weekday' demand/benefits and are then multiplied by 60%, whilst Sundays are factored by 40% compared to a weekday. These are simple average assumptions based on previous experience and are open to further testing/ refinement as further data may become available.

It is assumed that no services operate on Christmas Day or Boxing Day.

Table 3-10: Assumed Number of Operating Days per Year

Days	Days per Year
Weekdays	253
Saturdays & Bank Holidays	58
Sundays	52

Operating Days/Hours

In order to develop the operating costs for the station, opening hours have had to be assumed to work out staff requirements, and therefore costs. It has been assumed that the ticket office is staffed from 07:00-19:00 Monday to Saturday, and closed on Sundays and Bank Holidays. It is assumed one member of staff is required at any one time, each with a six-hour shift length.

Purpose Splits from COMET

Journey purpose splits have been derived from the COMET model for each time period. This provides a better estimate of local purpose splits than PDFH or TAG. The VoT are applied to each segment of demand, to calculate journey time savings benefits. The purpose splits which are applied in the model for each time period are shown in Table 3-11.

Table 3-11: Journey Purpose Splits by Time Period

	AM Peak	Inter Peak	PM Peak
Business	5%	6%	4%
Other	32%	84%	38%
Commute	63%	10%	57%

Source: Output from COMET Demand Model

3.5   Costs

Capital Costs

Our starting assumption for the capital cost for the station is £15m in 2017 prices, based on assessment of a range of other recent similar new railway stations, and the two key stations identified below. It is assumed this includes:

- 2x 255m platforms
- two entrances, each with a footbridge to both platforms, with one footbridge having lifts to both platforms
- One station building including a ticket office
- Ticket vending machines
- Utilities including water and electricity
- Access road alterations including a drop off point and bus stops, but no car parking facilities
- Any land acquisition costs
- All Network Rail costs (possessions/compensation, signalling etc.)

The stations we have benchmarked these costs against are Lea Bridge station, which opened in May 2016 at a cost of £11.6m (but with no staffing facilities), and Maghull North which is due to open in May 2018 at a cost of £13m with staffing facilities and a car park, but shorter platforms and one entrance/footbridge. As these stations are broadly similar in scope, but Turnford has a slight increase in facilities (Turnford is assumed to be staffed compared to Lea Bridge, and is assumed to have longer platforms and two entrances compared to Maghull North), then a slighter higher Capital Cost of £15m (in 2017 prices) is assumed, to be conservative.

As part of the business case, this cost is then adjusted based on the TAG assumptions described in section 3.3, by applying construction cost inflation in real terms to the expected years of construction (2030-2032), rebasing to 2010 values, optimism bias at an additional 64%, discounting, and conversion to Market Prices. This gives a Capital Cost (Present Value) for the business case of £14.6m.

Operating Costs

Operating costs per year of £181,611 (2017 prices) have been calculated. These are based on an average £45,000 for an unstaffed two platform station (in 2013 prices, £47,630 when converted to 2017 prices), plus the items below. This average unstaffed station cost comes from an Abellio quote for Lea Bridge station and our own internal database of costs:

- Additional utilities, maintenance and improvement costs for a staffed station
- Salaries and overheads for an assumed 3 members of staff being required plus cover
- Network Rail station Long Term Charge based on the rate of other similar stations nearby

These are then subject to cost inflation in real terms as with Capital Costs, but with staff cost increasing through the 60-year appraisal period whilst non-staff costs only increase to 2037 as per DfT TAG current guidance (Unit A5.3, Section 2.4.4). The costs are then rebased to 2010 values, optimism bias applied at an additional 41%, discounting, and conversion to Market Prices. Applying these gives a 60-year Operating Cost (Present Value) for the business case of just over £5m (£5.3m).

Station Long Term Charge (LTC)

The station LTC allows Network Rail (NR) to recover the efficient longer-term maintenance, renewal and repair costs associated with the stations it owns. There is a separate LTC for each station and it is a regulated charge, determined by ORR at each periodic review. Once NR takes ownership of Turnford station, it would charge the LTC to the operator and has been included in the operating cost forecast.

NR LTC's are published on its website[15], although stations in the Abellio Anglia region were not included here at the time of the analysis in November 2017. Instead, a range of similar stations close by, with facilities similar to those expected at Turnford were found and used to derive an average for Turnford. The calculation of the average NR LTC used for Turnford (assumed 2017 prices) is presented in Table 3-12.

Table 3-12: Stations Used to Calculate NR LTC for Turnford

Station	Station Facility Owner	Total Annual CP5 LTC
Arlesey	Govia Thameslink Railway	£24,069
Baldock	Govia Thameslink Railway	£16,332
Cuffley	Govia Thameslink Railway	£23,865
Welwyn North	Govia Thameslink Railway	£26,942
Average		**£22,802**

3.6   Station Usage and Benefits with Crossrail 2

The modelling shows that there are around 2,500 'entries' and 2,500 'exits' from the station during each 7am-7pm period on a weekday. Assuming most are return journeys this is around 2,500 round trips, or 5,000 single legs in the 12-hour period. Of these, around 1,000 are transfers from Cheshunt station (20-25% of Cheshunt demand in 2031) and around 100 passengers transfer from Broxbourne station (1-3% of Broxbourne demand in 2031). Therefore, resulting in 1,400 new rail entries and 1,400 new rail exits.

Figure 11 presents the change in walk volume in the COMET model in the 2031 AM Peak Average Hour between the 'without station' and 'with station' scenarios. Of the 350 entries per hour into

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[15] https://www.networkrail.co.uk/industry-commercial-partners/information-operating-companies/cp5-access-charges/

Turnford station, 120 of them come from the Brookfield development site zone to the west of the A10, around one third of the station demand. This pattern is similar in the other time periods.
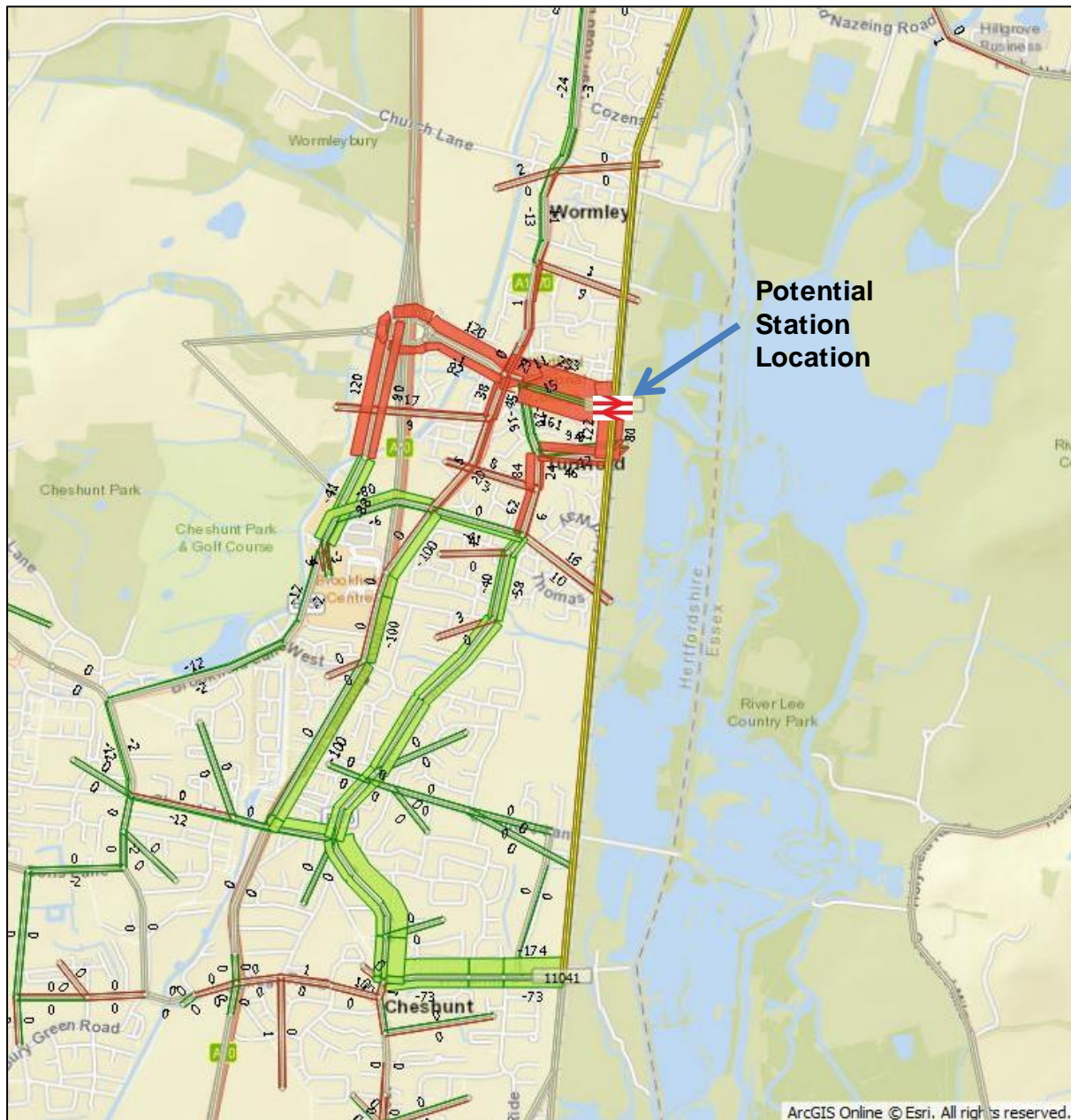
Figure 11: Change in Walk Volumes between 'without Station' and 'With Station' Scenarios, 2031 AM Average Hour

Note that the COMET model undertakes calculations between all zones, assigning trips to the shortest routes as well as calculating modal shift and generated trips as a result of changes in journey times. Accordingly, it also takes account of the increases in journey time between Broxbourne and Cheshunt on the rail services which stop at Turnford and the resultant reduction in demand/ loss of revenue/ benefits. These are implicit in all of the calculations undertaken for each element of the business case.

3.7   Revenue

Additional incremental rail revenue during each 12-hour period has been estimated at around £15,000, which is around £6 per 'round trip' using the station (£15,000 / 2,500). This might be

considered a low value, but it should be noted that 40% of trips are simply extending journeys to London by an extra stop (i.e. transferring from Cheshunt to Turnford).

Once demand has been uplifted to take account of the 7pm-7am off-peak period and weekends/Bank Holidays, total additional annual revenue of around £5m for the station in 2033 has been calculated. Lost bus revenue has also been taken into account in the business case assessment, and it has been calculated from the model to be around £275k per year.

3.8   User Time Savings

These have also been calculated from the model, by applying TAG rail user VoT to business, commuter and other users separately, as defined in TAG and discussed in section 3.3. This gives us around £7.4m in time savings benefits per year in 2033.

3.9   Highway Benefits

From the COMET highway model, we have calculated the reduction in car kilometres as a result of the scheme of £2.3m in 2033, due to modal transfer to rail from car. This leads to the following highway related benefits:

- Road decongestion
- Accidents
- Greenhouse gases
- Noise
- Infrastructure

3.10   Indirect Taxation

This is the impact to government of lost taxation revenue. This is two-fold, in that reduced car kilometres leads to reduced tax revenue from fuel, as well as the assumption that the extra money spent on rail fares (which are not taxed) means less is spent on taxable goods, and a loss of revenue to the government.

3.11   Summary of Impacts for Business Case

Each of the items outlined above are assessed over a 60-year appraisal period, and subject to discounting and conversion to market prices in line with TAG appraisal guidance. The total value calculated for each item in the business case is shown in Table 3-13.

Table 3-13: Summary of Benefits and Costs Calculated for Turnford Station with CR2

	Item	Present Value in Business Case
Benefits	Rail Revenue	£78.14m
	Bus Revenue	-£4.10m
	User Time Savings	£88.52m
	Road decongestion	£14.61m
	Accidents	£1.06m
	Greenhouse gases	£0.59m
	Noise	£0.07m
	Indirection Taxation	-£4.21m
	Operating Costs	-£5.32m
	Present Value of Benefits	**£169.38m**
Costs	Capital Cost	£14.59m
	Infrastructure	-£0.05m
	Present Value of Costs	**£14.53m**
Net Present Value (NPV)		**£154.85m**
Benefit:Cost Ratio		**11.7**

This leads to a TAG 'impact on Public Accounts' BCR of 11.7. The TAG tables which generate the BCR, and other metrics such as the Present Value of Benefits (PVB), Present Value of Costs (PVC) and Net Present Value (NPV), are shown in sections 3.12, 3.13 and 3.14.

Please note that this is a very early stage BCR based on indicative costs. Further development of costs specific to Turnford station and the access road and facilities required could vary and increase these costs over the assumptions that have been made.

It should also be remembered the COMET model does not seek to model Central London and does not measure the impacts of crowding (in other words the demand forecasts are unconstrained).

Recommendations for further work and sensitivity tests on the business case for the scheme are contained in chapter 6.

3.12 Economic Efficiency of the Transport System (TEE) Table

Economic Efficiency of the Transport System (TEE)

Non-business: Commuting	ALL MODES			BUS and COACH	RAIL	OTHER
			ROAD			
User benefits	TOTAL		LGVs	rs	Passengers	
Travel time	£62.15		£11.01		£51.14	
Vehicle operating costs	£0.00					
User charges	£0.00					
During Construction & Maintenance	£0.00					
NET NON-BUSINESS BENEFITS: COMMUTING	£62.15	*(1a)*	£11.01	£0.00	£51.14	£0.00

Non-business: Other	ALL MODES			BUS and COACH	RAIL	OTHER
			ROAD			
User benefits	TOTAL		LGVs	rs	Passengers	
Travel time	£30.26		£2.50		£27.76	
Vehicle operating costs	£0.00					
User charges	£0.00					
During Construction & Maintenance	£0.00					
NET NON-BUSINESS BENEFITS: OTHER	£30.26	*(1b)*	£2.50	£0.00	£27.76	£0.00

Business

			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	
User benefits								
Travel time	£10.73			£1.10			£9.63	
Vehicle operating costs	£0.00							
User charges	£0.00							
During Construction & Maintenance	£0.00							
Subtotal	£10.73	*(2)*	£0.00	£1.10	£0.00	£0.00	£9.63	£0.00
Private sector provider impacts						Freight	Passengers	
Revenue – Rail	£78.14						£78.14	
Revenue – Bus	–£4.10						–£4.10	
Operating costs	–£5.32						–£5.32	
Investment costs	£0.00							
Grant/subsidy	£0.00							
Revenue Transfer	£0.00							
Subtotal	£68.71	*(3)*			£0.00	£0.00	£68.71	£0.00
Other business impacts								
Developer contributions	£0.00	*(4)*						
NET BUSINESS IMPACT	£79.44	*(5) = (2) + (3) + (4)*						

TOTAL		
(TEE)	£171.85	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

3.13   Public Accounts (PA) Table

Public Accounts (PA) Table

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	TOTAL		INFRASTRUCTURE			
Revenue	£0.00					
Operating Costs	£0.00					
Investment Costs	£0.00					
Developer and Other Contributions	£0.00					
Grant/Subsidy Payments	£0.00					
NET IMPACT	£0.00	(7)	£0.00	£0.00	£0.00	£0.00
Central Government Funding: Transport						
Revenue	£0.00					
Operating costs	£0.00					
Investment Costs	£14.53		-£0.05		£14.59	
Developer and Other Contributions	£0.00					
Grant/Subsidy Payments	£0.00					
NET IMPACT	£14.53	(8)	-£0.05	£0.00	£14.59	£0.00
Central Government Funding: Non-Transport						
Indirect Tax Revenues	£4.21	(9)	£0.43		£3.77	
TOTALS						
Broad Transport Budget	£14.53	(10) = (7) + (8)				
Wider Public Finances	£4.21	(11) = (9)				
	Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.					
	All entries are discounted present values in 2010 prices and values.					

3.14   Analysis of Monetised Costs and Benefits (AMCB) Table

Analysis of Monetised Costs and Benefits

Noise	£0.07	(12)
Local Air Quality	£0.01	(13)
Greenhouse Gases	£0.59	(14)
Journey Quality		(15)
Physical Activity		(16)
Accidents	£1.06	(17)
Economic Efficiency: Consumer Users (Commuting)	£62.15	(1a)
Economic Efficiency: Consumer Users (Other)	£30.26	(1b)
Economic Efficiency: Business Users and Providers	£79.44	(5)
Wider Public Finances (Indirect Taxation Revenues)	-£4.21	- (11) - sign changed from PA table, as PA table represents costs, not benefits
Present Value of Benefits (see notes) (PVB)	£169.38	(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)
Broad Transport Budget	£14.53	(10)
Present Value of Costs (see notes) (PVC)	£14.53	(PVC) = (10)
OVERALL IMPACTS		
Net Present Value (NPV)	£154.85	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	11.7	BCR=PVB/PVC

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

3.15   Sensitivity Tests on 'with CR2' Scenario

Two key sensitivity tests have been undertaken, around the assumed business value of time for short distance rail users, and whether demand growth is capped in 2037 or not.

The VoT test is around the guidance presented in section 3.3 from TAG (July 2017), which recommends a continuous VoT function is used for business trips based on distance travelled for each user. The average business VoT for rail journeys of 0-50km has been used, as this will cover the vast majority of trips between Turnford and London. However, in order to show that this assumption has no material impact on the BCR, a test using the minimum business VoT for a rail trip of 0km has been undertaken. This VoT is £6.85/hr compared to the £10.02/hr applied and leads to a BCR of 11.4 instead of 11.7.

As noted in section 3.3, demand growth is capped 20 years after the year of appraisal (2037) as recommended in TAG (July 2017). However, this assumption has always led to some debate as population and GDP is forecast to continue to grow beyond this point and therefore growth in rail demand would be expected to continue. Forthcoming guidance was available regarding planned changes to TAG in December 2017, and this assumption is to be replaced with guidance that demand should be forecast to continue to grow in line with population, subject to evidence that capacity will not be exceeded.

Changing this assumption and using the TAG population forecast in the July 2017 Databook to continue to growth demand through to 2092 changes the BCR to 12.9.

3.16   Updated TAG and PDFH guidance and 'without CR2 tests'

Given the uncertainty concerning CR2 implementation before the planned opening date of Turnford station, further scenarios were tested to assess whether Turnford station could be economically viable without CR2 in operation, and hence could opening be potentially brought forward. In these tests, the CR2 services are removed from the COMET scenarios used to test the impact of Turnford station.   The journey times with and without a stop at Turnford are consistent to those used in the with CR2 test.

The removal of CR2's 12 tph would result in *only* 2 tph calling at Turnford station. Both trains per hour would be the Hertford East to Stratford service (which is assumed to operate all day in the COMET v2 future year 'Reference Case' scenario). The service does not provide the same city centre connectivity as CR2, with Stratford being in London zone 2/3. However, short interchange to Liverpool Street services and the Victoria London Underground line are available at Cheshunt or Tottenham Hale, and so the impact on journey times would be limited.

A total of three tests were carried out.

The first tested the economic impact of using the latest TAG and PDFH values (as at early 2020) in the 'with CR2' scenario. Although, as stated earlier, CR2's implementation is uncertain, this test is necessary to understand the impact of new TAG and PDFH values on a "With CR2" scenario and resultant BCR.

The second test kept TAG and PDFH values and guidance the same as originally tested in 2017, i.e. as those stated in in Table 3-3 to Table 3-9, but in a scenario where CR2 is not implemented. This test demonstrates the impact of not having CR2 services call at Turnford, whilst retaining the same economic analysis assumptions.

The third test combines the two updates above, assessing the business case for Turnford in a 'without CR2' scenario, with CR2 and with use of up to date TAG and PDFH values. For TAG, this was guidance/appraisal methods as of March 2020 and PDFH version 6.0. Table 3-14 below summarises the three tests.

For all intents and purposes. the original work – With CR2, TAG as of Sep 2017 – will be referred to the *Core* scenario.

Table 3-14: Additional test summary

Test No.	Description
1	With CR2, TAG as of Mar 2020
2	Without CR2, TAG as of Sep 2017
3	Without CR2, TAG as of Mar 2020

Latest TAG (March 2020) and PDFH (v 6.0) figures can be found in Table 3-15 to Table 3-20. Key changes have included: updates to the GDP deflator – and subsequent construction cost inflation differentials; a reduction to the average year 4 lag; and the removal of a 20-year demand cap (as noted in section 3.15). These values have been applied to *Test 1* and *Test 3* only*.*

The appraisal year has been updated to 2020 (see Table 3-16). For consistency, and for a more meaningful comparison with the *Core*, *Test 2'*s appraisal year has remained 2017.

Journey purpose splits by time period have also been updated, also (see Table 3-21). However, *Test 1*'s journey purpose splits have not changed from the *Core*. Just like the appraisal year remaining as 2017 in *Test 2*, keeping the purpose splits the same allows for a fairer comparison.

Table 3-15: TAG Updated Document Versions Applied

Databook	May 2019
Unit A1.1 Cost Benefit Analysis	May 2018
Unit A1.2 Cost Estimation	July 2017
Unit A1.3 User and Provider Impacts	May 2019
Unit A5.3 Rail Appraisal	May 2018
Unit M4 Forecasting and Uncertainty	May 2019

Table 3-16: Years Assumed in the Appraisal for Tests 1 and 3

TAG Price Base	2010
Appraisal Year	2020
Construction Start Year	2030
Construction Complete Year	2032
Opening Year	2033
End of Appraisal Year	2092

The updated TAG assumptions applied to Tests 1 and 3 are set out in the Tables below, where values have changed from previous tables/versions used.

Table 3-17: TAG Discount Rates Applied

Years from Current Year			
From	To	Discount Rate	Years Applies to
0	30	3.50%	2020 to 2050
31	75	3.00%	2051 to 2092
76	125	2.50%	N/A
126	200	2.00%	N/A
201	300	1.50%	N/A
301	301	1.00%	N/A

Source: TAG Databook (May 2019), Table A1.1.1

Table 3-18: TAG Values of Time by Trip Purpose Relevant to Rail Passengers

Trip Purpose	£ per hour, 2010 prices, 2010 values, Market Price
Employers Business, Rail Passenger 0-50km	10.02
Commuting	9.95
Other	4.54

Source: Adapted from TAG Databook (May 2019), Table A1.3.1

Note that whilst values of time in 2010 remain the same, forecast changes in VoT in future years are different in different TAG versions, and updated forecasts have been used.

Table 3-19: Construction Cost Inflation Compared to TAG GDP Deflator, 2010 - 2016

Year	Construction Cost Inflation	GDP Deflator	Difference
2010	-4.10%	1.54%	-5.64%
2011	0.00%	1.92%	-1.92%
2012	3.28%	1.59%	1.69%
2013	3.27%	1.93%	1.34%
2014	5.34%	1.81%	3.53%
2015	2.30%	0.47%	1.83%
2016	2.36%	2.22%	0.14%

Source: ONS Construction Cost Inflation[13], TAG Databook (May 2019), 'Annual Parameters' Table

Table 3-20: PDFH Recommended Demand Lags for Major New Rail Services

2033	2034	2035	2036
Average Year 1	Average Year 2	Average Year 3	Average Year 4
53%	78%	90%	98%

Source: PDFH v6, Table B9.7

Table 3-21: Journey Purpose Splits by Time Period

	AM Peak	Inter Peak	PM Peak
Business	5%	6%	5%
Other	31%	83%	38%
Commute	64%	10%	58%

Source: Output from COMET Demand Model

Test 1 – With CR2 (New TAG and PDFH Parameters)

There was a small impact on the benefits and costs of Turnford station when the latest TAG and PDFH values were used (see Table 3-22). The BCR has increased from the Core to **Test 1**, from 11.7 to 12.7 (see Table 3-13). **Test 1**'s PVB is higher than in the **Core**; whilst the PVC is lower than in the **Core**.

Table 3-22: Test 1's Summary of Benefits and Costs Calculated for Turnford Station

	Item	Present Value in Business Case
Benefits	Rail Revenue	£77.96m
	Bus Revenue	-£4.09m
	User Time Savings	£97.81m
	Road decongestion	£13.45m
	Accidents	£1.88m
	Greenhouse gases	£0.37m
	Noise	£0.13m
	Indirection Taxation	-£4.05m
	Operating Costs	-£5.06m
	Present Value of Benefits	**£178.11m**
Costs	Capital Cost	£14.08m
	Infrastructure	-£0.06m
	Present Value of Costs	**£14.03m**
Net Present Value (NPV)		**£164.09m**
Benefit:Cost Ratio		**12.7**

Test 2 – Without CR2 (Original TAG and PDFH Parameters)

In spite of a reduction in service frequency calling at Turnford, there remains a positive BCR of 5.1 in *Test 2*. This demonstrates a very high Value for Money (VfM). A breakdown of benefits across a 60-year appraisal are shown in Table 3-23.

Table 3-23: Test 2's Summary of Benefits and Costs Calculated for Turnford Station

	Item	Present Value in Business Case
Benefits	Rail Revenue	£40.10m
	Bus Revenue	-£1.43m
	User Time Savings	£34.91m
	Road decongestion	£6.74m
	Accidents	£0.49m
	Greenhouse gases	£0.27m
	Noise	£0.03m
	Indirection Taxation	-£2.17m
	Operating Costs	-£5.32
	Present Value of Benefits	**£73.67m**
Costs	Capital Cost	£14.59m
	Infrastructure	-£0.03m
	Present Value of Costs	**£14.56m**
Net Present Value (NPV)		**£59.11m**
Benefit:Cost Ratio		**5.1**

Test 3 – Without CR2 (New TAG and PDFH Parameters)

As with **Test 1**, the use of 2020 TAG and PDFH v6 values has a small impact on the PVB and PVC (see Table 3-24); as shown in a comparison of the two "Without CR2" scenarios. The PVB increases from £73.67m in **Test 2** to £76.00m in **Test 3**, a 3% growth; and the PVC falls from £14.56m in **Test 2** to £14.06m, a 3% drop. This leads to a BCR of 5.4, still a very high value for money.

Table 3-24: Test 3's Summary of Benefits and Costs Calculated for Turnford Station

	Item	Present Value in Business Case
Benefits	Rail Revenue	£41.22
	Bus Revenue	-£1.47m
	User Time Savings	£36.21m
	Road decongestion	£6.39m
	Accidents	£0.89m
	Greenhouse gases	£0.18m
	Noise	£0.06m
	Indirection Taxation	-£2.12m
	Operating Costs	-£5.37m
	Present Value of Benefits	**£76.00m**
Costs	Capital Cost	£14.08m
	Infrastructure	-£0.03m
	Present Value of Costs	**£14.06m**
Net Present Value (NPV)		**£61.95m**
Benefit:Cost Ratio		**5.4**

Test 3 is the "best case" model (without CR2 and with the latest TAG and PDFH parameters) and therefore, the TEE, PA and AMCB tables have been completed for this test as shown in sections 3.17, 3.18, and 3.19 respectively.

3.17 Without Crossrail 2 Economic Efficiency of the Transport System (TEE) Table

Economic Efficiency of the Transport System (TEE)

Non-business: Commuting	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		LGVs	rs	Passengers	
Travel time	£27.02		£4.96		£22.06	
Vehicle operating costs	£0.00					
User charges	£0.00					
During Construction & Maintenance	£0.00					
NET NON-BUSINESS BENEFITS: COMMUTING	£27.02	*(1a)*	£4.96	£0.00	£22.06	£0.00

Non-business: Other	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		LGVs	rs	Passengers	
Travel time	£11.31		£0.94		£10.37	
Vehicle operating costs	£0.00					
User charges	£0.00					
During Construction & Maintenance	£0.00					
NET NON-BUSINESS BENEFITS: OTHER	£11.31	*(1b)*	£0.94	£0.00	£10.37	£0.00

Business

User benefits			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	
Travel time	£4.27			£0.49			£3.78	
Vehicle operating costs	£0.00							
User charges	£0.00							
During Construction & Maintenance	£0.00							
Subtotal	£4.27	*(2)*	£0.00	£0.49	£0.00	£0.00	£3.78	£0.00

Private sector provider impacts						Freight	Passengers	
Revenue – Rail	£41.22						£41.22	
Revenue – Bus	−£1.47						−£1.47	
Operating costs	−£5.37						−£5.37	
Investment costs	£0.00							
Grant/subsidy	£0.00							
Revenue Transfer	£0.00							
Subtotal	£34.38	*(3)*			£0.00	£0.00	£34.38	£0.00

Other business impacts								
Developer contributions	£0.00	*(4)*						
NET BUSINESS IMPACT	£38.65	*(5) = (2) + (3) + (4)*						

TOTAL								
(TEE)	£76.98	*(6) = (1a) + (1b) + (5)*						

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

3.18 Without Crossrail 2 Public Accounts (PA) Table

Public Accounts (PA) Table

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	TOTAL		INFRASTRUCTURE			
Revenue	£0.00					
Operating Costs	£0.00					
Investment Costs	£0.00					
Developer and Other Contributions	£0.00					
Grant/Subsidy Payments	£0.00					
NET IMPACT	£0.00	(7)	£0.00	£0.00	£0.00	£0.00
Central Government Funding: Transport						
Revenue	£0.00					
Operating costs	£0.00					
Investment Costs	£14.06		-£0.03		£14.08	
Developer and Other Contributions	£0.00					
Grant/Subsidy Payments	£0.00					
NET IMPACT	£14.06	(8)	-£0.03	£0.00	£14.08	£0.00
Central Government Funding: Non-Transport						
Indirect Tax Revenues	£2.12	(9)	£0.17		£1.96	
TOTALS						
Broad Transport Budget	£14.06	(10) = (7) + (8)				
Wider Public Finances	£2.12	(11) = (9)				
Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.						
All entries are discounted present values in 2010 prices and values.						

3.19   Without Crossrail 2 Analysis of Monetised Costs and Benefits (AMCB) Table

Analysis of Monetised Costs and Benefits

Noise	£0.06	(12)
Local Air Quality	£0.01	(13)
Greenhouse Gases	£0.18	(14)
Journey Quality		(15)
Physical Activity		(16)
Accidents	£0.89	(17)
Economic Efficiency: Consumer Users (Commuting)	£27.02	(1a)
Economic Efficiency: Consumer Users (Other)	£11.31	(1b)
Economic Efficiency: Business Users and Providers	£38.65	(5)
Wider Public Finances (Indirect Taxation Revenues)	-£2.12	- (11) - sign changed from PA table, as PA table represents costs, not benefits
Present Value of Benefits (see notes) (PVB)	£76.00	(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)
Broad Transport Budget	£14.06	(10)
Present Value of Costs (see notes) (PVC)	£14.06	(PVC) = (10)
OVERALL IMPACTS		
Net Present Value (NPV)	£61.95	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	5.4	BCR=PVB/PVC

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

4. The Financial Case

4.1 Annual Assessment

The Financial Case has only so far been completed for the original 'with CR2' test in this version of the report. It is intended that this be fully updated in due course for all scenarios and considering additional information.

Taking each of the calculated costs and benefits for the station at an annual level, prior to undertaking the conversations required for the business case, gives an indication of the viability of the new station at Turnford on an ongoing basis.

Table 4-1 presents the annual costs and benefits in 2036 (the first year of full demand after the ramp-up period outlined in section 3.4), in 2010 prices including Optimism Bias on operating cost.

Table 4-1: Summary of Costs and Benefits, Annual, 2036

Element	Cost in 2036 (2010 Prices)
Operating Cost	-£0.29m
Rail Revenue	£5.33m
Bus Revenue	-£0.28m
Total	**£4.76m**

4.2 Funding for New Stations

Local authorities are expected to take the initiative to develop rail schemes in their area that are not deemed to be of strategic national importance (which would be the responsibility of central government). Thus, for schemes such as a new rail station, the responsibility will be on the local authority to develop the scheme and secure the necessary funding, just as it would if the scheme happened to be a local road scheme or a bus based scheme.

Most funding for local infrastructure schemes is secured from Growth Funds channelled through the LEPs. Some local authorities will have access to other sources of capital funding, such as tapping into existing capital funding pots, donated land (e.g.: Homes and Communities Agency) and/or developer contributions (Section 106). The latter can be an important source of funding not only in terms of securing valuable contributions, but also in terms of providing appropriate evidence to support the securing of Growth Funding. For example, Lea Bridge station (opened 2016) was funded by nearly 50% Section 106 developer contributions from the nearby Westfield development at Stratford.

Examples of capital funding sources:

Station	Growth Funding	Other Council Source	Developer	New Station Fund
Lea Bridge	0%	43%	47%	10%
Warrington West	33%	36%	9%	22%
Maghull North	82%	14%	4%	0%
Ilkeston	0%	26%	10%	64%

The government has established the New Stations Fund, which has now had two rounds of funding bids allocated to schemes across the UK. Typically for each round there is circa £20m made available and circa 4 to 5 new stations are allocated funding from this pot, which is administered by Network Rail on behalf of government.

The second consideration for possible funding in relation to a new station is the extent to which any ongoing funding may be required once the new station has opened. Where a train operator believes that it may not be commercial to introduce the new station, the local authority may have to be prepared to fund the additional subsidy required for a period of at least three years.

Warrington West ownership model:

Station Infrastructure	Owner	Operator
Platforms, bridges and lifts	Network Rail	SFO
Buildings and access	Local Authority	SFO
Car park	Local Authority	Local Authority

For a new station the main train operator (the Station Facility Owner, or SFO) will be responsible for the day-to-day management and operating the station, including collecting farebox revenue, but typically will not own the infrastructure. In most cases Network Rail would own the station infrastructure and be responsible for the maintenance, repair and renewal (MRR) of the station. It imposes a Long Term Charge (LTC) on the SFO to cover these costs.

However, different ownership models for stations can be followed – there are some examples of station buildings and/or car parks being owned and/or operated by the local authority. For example, the ownership model used at Warrington West station (opened in 2019) is summarised in the box opposite. In this case, the SFO will pay a reduced LTC to Network Rail (covering the platforms and bridges) and a management fee to the local authority (covering the station building).

5.   The Commercial Case & The Management Case

This section summarises the detail which needs to be provided as part of a completed SOBC for the scheme for submission to DfT, in line with TAG guidance. These elements are areas which BBC needs to consider how they might approach as part of delivering the new station and are presented in Table 5-1.

The Commercial and Management Cases have only so far been completed for the original 'with CR2' test in this version of the report. It is intended that this be fully updated in due course for all scenarios and considering additional information.

5.1   Evidence of similar projects

It has been noted earlier through this report that a similar new station was successfully delivered at Lea Bridge in London, which opened in May 2016. This station is located along the same rail corridor as Turnford, between Tottenham Hale and Stratford.

Table 5-1: Summary of Information Required for the Commercial & Management Cases

Item	Detail to Be Provided
Procurement strategy	Detail procurement/ purchasing options including how to secure the economic, social and environmental factors outlined in the economic case
Programme / Project Dependencies	Set out deliverables and decisions that are provided/ received from other projects
Governance, organisational structure & roles	Describe key roles, lines of accountability and how they are resourced
Programme / project plan	Outline project plan with key milestones and progress, including critical path
Assurance & approvals plan	Outline project timeline with key assurance and approval milestones
Communications and stakeholder management	Develop communications strategy for the project, identifying how stakeholders identified in section 2.9 will be kept updated and involved in contributing to the scheme
Programme / project reporting	Describe reporting arrangements
Risk management strategy	Arrangements for risk management and its effectiveness so far
Options	Summarise overall approach for project management at this stage of project

6.   Summary and Recommendations for Next Steps

6.1   Summary

This report has presented the initial analysis undertaken on the business case for a potential new railway station at Turnford, building towards a full SOBC. Further development work is required to take the project to a full SOBC, in particular:

- More detail on the Strategic Case and need for the scheme in the context of local policy aspirations;
- Further evidence on how this particular option has been selected from the long list of options, and potentially presenting the business case in this manner for the option options;
- Development of the Management and Commercial Cases as required by DfT; and
- Undertaking a range of sensitivity tests on the assumptions made, particularly regarding demand growth (high/ low tests).

The report outlines initial estimates of costs and benefits for a range of tests. The **Core** test, which includes CR2 and uses TAG as of September 2017 and PDFH v5.1, yields a BCR of 11.7. This is exceptionally high. What makes it a particularly favourable proposition are its high frequency of CR2 services; journey time savings for the local population who no longer need travel to Broxbourne and Cheshunt stations, and location to proposed major developments. It also has the potential to shift people from highway to PT; which, in turn, can draw environmental benefits and align to local and national government policy objectives.

However, given the uncertainty around CR2, further tests were carried out to assess whether Turnford could still provide a positive BCR without CR2. Of these tests, **Test 3** was a "best case" scenario. In addition to the removal of CR2, **Test 3**'s TAG and PDFH values were updated to reflect the most up-to-date values (as of March 2020). The result was a BCR of 5.4. In spite of the reduction in the number of trains calling at Turnford, this is still very good. It demonstrates that the station is still economically viable without CR2 going ahead. Whilst a separate timetable analysis has identified a workable timetable to include the station stop, this is likely to have a train performance impact on the corridor, which would need to be considered during the station development.

6.2   Recommended Next Steps

Analysis of the demand for the station produced by the COMET model show the station is heavily reliant on the population growth in the Brookfield development, and therefore if these new housing development proposals do not come forward in the scale currently assumed in the modelling then the demand and benefits will be reduced. It is recommended additional sensitivity tests are undertaken with the Brookfield Riverside and Brookfield Garden Village developments removed or reduced in scale, to understand the impact on the business case for the scheme should these not come forward or the development happens at a slower rate than assumed.

As noted in Section 3.2, the version of the COMET model used (v2) does not model combined bus and rail trips. Exploring model testing to more accurately assess multi-mode trips (such as bus access to the new rail station) or a more detailed analysis of potential access by bus beyond the 2km walking catchment is recommended.

BBC should also consider developing the Commercial Case and Management Case elements of the SOBC, for any potential submission to DfT, particularly for any application for money from the New Stations funds, etc.

Costs should be refined, with a specific capital cost calculation for Turnford made based on the station layout as presented and the access arrangements assumed.