Councils Response to Stage 1 Matters, Issues, Questions Thursday 12th December 2019.

Matter 7 – The Broad Locations for Development – Specific Matters (Policy S6 (i) to (xi)

Main Issue

Whether the detailed policy for each broad location for development is justified, effective and consistent with national policy.

Park Street Garden Village S6 (xi)

1. Question 1

Is the site suitable for housing and are there any specific constraints or requirements associated with it, or the need for mitigation measures?

1.1 Yes, as demonstrated in the Councils strategic site evaluations work, the site is considered suitable for housing. Potential significant constraints, requirements and mitigations were directly considered in the Draft Strategic Site Selection Evaluation Outcomes methodology as set out Planning Policy Committee March 2018.

The evaluation uses the criteria below, based on the approach in PPC reports mentioned above (and as similarly set out in the Call for sites and Local Plan regulation 18 consultation background materials).

Stage 1

1. *Green Belt Review evaluation will be undertaken on the basis of a judgement of impact on (i.e. 'damage' to) Green Belt purposes (taking account of the purposes defined in and considered in the relevant parcel assessment in the GBR). Sites are rated as 'higher impact', 'medium impact' or 'lower impact' (set out as Red Amber Green (RAG)). It is important to remember that the independent Green Belt Review set out that "All strategic parcels in the Green Belt, at least in part, clearly perform a key role". The assessment is a comparative one in the context of understanding relative impacts on the Green Belt. To achieve 'further consideration for development' the site must be evaluated as lower or medium impact (Green or Amber). Any Red rating (higher impact) will rule a site out for further consideration.*

Stage 2

2. *Suitability will set out as (Red Amber Green) if there are any issues which are overriding constraints to development – eg Access, Transport, Heritage, Biodiversity, Flood Risk. Any Red rating will rule a site out for further consideration.*

3. *Availability will set out as (Red Amber Green) if there are any issues which are overriding constraints to development in terms of land ownership, restrictive covenants etc. Any Red rating will rule a site out for further consideration.*

Stage 3

4. *Unique contribution to improve public services and facilities, e.g. public transport - (set out as Red Amber Green). Any Green rating is considered to be potentially significantly positive at a District wide (or even wider) scale.*

5. *Unique contribution to enhancing local high quality job opportunities and the aspirations of the Hertfordshire Local Economic Partnership / Hertfordshire EnviroTech Enterprise Zone - (set out as Green Amber Red). Any Green rating is considered to be potentially significantly positive at a District wide (or even wider) scale.*

6. *Unique contribution to other infrastructure provision or community benefits - (set out as Red Amber Green). Any Green rating is considered to be potentially significantly positive at a District wide (or even wider) scale*

7. *Deliverable / Achievable is there is a reasonable prospect that the development, including all key aspects (including viability) being assessed as part of the overall 'package' proposed, is viable and deliverable (set out as Red Amber Green). Any Red rating will rule a site out for further consideration. 8. An overall evaluation judgement will be recorded (set out as Red Amber Green) as how the site is evaluated for further consideration for development in the Plan."*

1.2 This methodology identified two levels of constraints in the site assessment;

- Level 1: Overriding Constrains that would rule out sites as potentially 'suitable'.
- Level 2: Constraints that would need specific requirements and mitigations.

1.3 The following specific constraints were identified as part of the strategic site evaluations;

- Flood Zone 2 and 3.

1.4 The specific constraints, requirements and mitigations are also being taken into account as part of the Masterplanning processes, including the mitigation of impacts from flooding, as set out in more detail in response to M7xiQ8.

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2. Question 2

What are the implications of providing a new garden village on the site of an approved Strategic Rail Freight Interchange and how have these been dealt with?

2.1 In responding to Matter 6 Question 19 in considerable detail, the Council considers that this question has also been addressed.

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3. Question 3

What evidence is there to demonstrate that the garden village is capable of delivering 2,300 dwellings (including 600 beyond the plan period)?

3.1 The primary evidence is set out in Annex 1 of the draft Local Plan at page 98. This sets out all of the Broad Location area and Base Capacity Calculations in Hectares. For Park Street Garden Village this sets out;

Broad Location (BL)	***BL Wider Area (Ha) (Purple on Policies Map)***	***Broad Location Non-Green Belt Area (Ha) i.e. Area to be removed from GB***	***60/40 resi / non-resi split on BL Wider Area***	***60/40 resi / non-resi split on non-GB Area***	***New Education Site in GB up to (Ha)***	***Net developable area when education sites are in Green Belt - 80% of Non-Green Belt area***	***SADC net developable area for capacity calculations x 40 dwellings per hectare =***
Park Street Garden Village	*186.0*	*97.7*	*111.6/74.4*	*58.6/39.1*			*58.6x40 = 2344*

3.2 In this instance, 60% of the area to be removed from the GB is used as a basis for the capacity. There is the accompanying assumption that 40% of the area to be removed from the Green Belt is infrastructure and open space. The reasoning for this has been set out as Strategic Local Plan Background Note: Residential Density October 2014 (HOU 015);

Gross density calculations can be used to estimate and illustrate the potential development capacity of a site. The Green Belt Review Part 2 (SKM Enviros Consultancy Study) used the approach that up to 60% of the Gross Development Area (GDA) would be developed (termed Net Development Area) and the remaining 40% would be required to provide infrastructure, main roads, open space and public facilities.

Therefore 58.6 (developable area) x 40 (dwelling per hectare) = 2,344 dwellings. A small rounding down has then been applied to 2,300.

3.3 The appropriate densities to use and areas to which they would be applied was addressed on several occasions at PPC, including in particular PPC report January 2014, which sets out;

It is considered that 40dph is a relatively 'safe', robust assumption which can be readily achieved in suburban location housing developments in the District, particularly with a dwelling mix similar to that indicated in the recent Strategic Housing Market Assessment (SHMA). This simple calculation makes no specific allowance for infrastructure and major open space in larger development areas…

Appendix 1 provides a summary of the "Strategic" Green Belt land releases as recommended by SKM. For these areas SKM identified potential development parcels and calculated a dwelling capacity range based on net densities of 30 – 50dph. It is recommended that Plan

policies are developed on the basis of achieving a mid-range overall target minimum density of 40dph. This will necessitate some higher suburban density forms of development in some locations.

3.4 Furthermore, as set out in Strategic Local Plan Background Note: Residential Density October 2014 (HOU 015), a draft of which was presented to PPC July 2014. This is includes as M7xiQ3 Appendix 1.

Work on density assumptions in the draft Strategic Local Plan (SLP) is based on HCA research, in the form of a density matrix (Table 3.3 from the Homes and Communities Agency Urban Design Compendium – reference below). The matrix links typical residential densities to urban form ('creating urban structure'). It draws on examples of development across the UK and Europe. Average densities are based on case studies analysed as part of the Sustainable Residential Quality: Exploring the housing potential of large sites research. The matrix recommends that residential densities of 30 to 50 DPH (alongside related services) should be applied in suburban locations. This is considered to be relevant to the SKM identified sub areas assessed for the draft SLP, as they are located on the edges of existing settlements and exhibit suburban characteristics.

3.5 The Landowner confirmed the capacity was appropriate, deliverable and supported as part of landowner / developer submissions summer 2018.

3.6 The early Masterplanning work with relevant stakeholders demonstrates that this Broad Location is capable of delivering homes 2,300.

4. Question 4

What further infrastructure work (including technical and environmental studies) needs to be undertaken, and is this appropriate to be left to the masterplanning stage?

4.1 Yes, further infrastructure work is required to be undertaken, and this has been identified in the Infrastructure Delivery Plan 2018/19 (INFR 001). A list of infrastructure assessed for capacity is included in M7xiQ4 Appendix 1. For Park Street Garden Village this is summaries below;

LOCATION	***Park Street Garden Village***
Infrastructure	
Transport Infrastructure:	
Strategic - LTP4 major scheme	*Y*
Local highway - on & off site	*Y*
Sustainable travel - public transport	*Y*
Sustainable travel - walking + cycling on & off site	*Y*
Education:	
Primary (assumes £8.7m per new 2FE primary school or £12.4m per new 3FE primary school)	*1 x 3fe 1 x 2fe*
Secondary (assumes £37.3m per new 8FE secondary school)	*1 x 6-8fe*
Early years	*Y*
Green Infrastructure:	*CMO*
Strategic open space	*Y**
Local open space / play space	*Y*
Community Facilities:	
Health sq. m est floorspace provided onsite	*549*
Other community provision	*Y*
Neighbourhood Centre / Local Centre sq. m est net floorspace at groundfloor	*1380*
SUDS	*Y*
Energy Strategy / Renewable energy	*Y*
Digital Infrastructure	*Y*

4.2 As set out in Policy S6 xi), much of this infrastructure is set out as a policy requirement. As set out in the Council's response to M6 Q5, early progress has been made in respect of Masterplanning for the Broad Location at Park Street Garden Village. This has included co-operations with parties expected to deliver this infrastructure such as Hertfordshire County Council, NHS and developers, and the detail is considered to be appropriate and realistic for this stage of the process.

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5. Question 5

What is the justification for the substantial new Country Park and have its financial implications been considered?

5.1 The Council considers that the substantial new Country Park is justified and its financial implications have been considered. The requirement for the Country Park was derived initially through the initial work undertaken to investigate the potential of the Broad Locations in spring/summer 2018. This was primarily undertaken through the Strategic Sites Selection work and in discussion with the landowner/developer team. That work took appropriate account of the fact that the Broad Location falls wholly within the Watling Chase Community Forest and is of sufficient scale to offer a Country Park facility. PSGV also lies in a part of the District, unlike many other parts of the District, where there is no existing equivalent publicly accessible Country Park. The role is explicitly to provide facilities for both the existing and new communities, as set out at S6xi:

9 A substantial new Country Park providing facilities for new and existing communities

5.2 As also set out in the Plan at Policy L29 – Green and Blue Infrastructure, Countryside, Landscape and Trees:

Green and Blue Infrastructure

The proposed 'Key Green Infrastructure Network' (outside the urban areas) is set out at Figure 2. Conservation and enhanced public access improvements to this Green Infrastructure Network is a high priority. Opportunities are detailed in the Strategic and District Green Infrastructure Plans that support this Plan.

New green infrastructure is to be provided as part of development at selected Broad Locations for Development as shown on the Policies Map. Other major planned improvements are also shown on the Policies Map.

The Green Infrastructure Network in the Category 1 and 2 Settlements will be protected as Local Green Space (Policy L26). Elsewhere it is protected as part of the Green Belt.

In particular opportunities will be sought for:

- *Continued implementation of the Watling Chase Community Forest Plan especially in association with development at the Park Street Garden Village and London Colney Broad locations. Development within Watling Chase Community Forest will be considered against the Watling Chase Supplementary Planning Guidance (SPG) . The Council will welcome detailed proposals for the purposes of landscape conservation, improved access, recreation, nature conservation and timber production through planning obligations in line with the Watling Chase SPG*

5.3 It can also be noted that, as also addressed in response to Matter 4 Question 6, the required approach to Council-led Masterplanning as set out at S6 provides the opportunity through the Masterplanning process to seek 'compensatory improvements to the environmental quality and accessibility of the Green Belt' as is now part of the PPG. The new approach in the PPG sets out:

Where it has been demonstrated that it is necessary to release Green Belt land for development, strategic policy-making authorities should set out policies for compensatory improvements to the environmental quality and accessibility of the remaining Green Belt land. These may be informed by supporting evidence of landscape, biodiversity or recreational needs and opportunities including those set out in local strategies, and could for instance include:

new or enhanced green infrastructure;
woodland planting;
landscape and visual enhancements (beyond those needed to mitigate the immediate impacts of the proposal);
improvements to biodiversity, habitat connectivity and natural capital;
new or enhanced walking and cycle routes; and
improved access to new, enhanced or existing recreational and playing field provision.

5.4 It can also be noted that HCC supported the S6 Policy as a whole, including the inclusion of the requirement for a Country Park in their landowner/developer 'Annex 1' submission in summer 2018 and their Plan Regulation 19 formal response in October 2018.

5.5 With regard to consideration of its financial implications, these have been considered in overall terms as part of the St Albans CIL and Viability Report Final Draft – November 2017 (INFR 009) and the CIL LP Viability Strategic Site Testing (INFR Sep 2019 SADC CIL LP Viability Strategic Site Testing). This latter document sets out clearly an indicative £4.6 million (at £2,000 per dwelling) for the 'strategic open space / green infrastructure', of which the Country Park is the predominant item. For the avoidance of doubt, this specific viability assumption is in addition to the more local open space / play space / Green Infrastructure contribution, as set out in the PSGV appendix.

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6. Question 6

Does the Abbey Railway Line have capacity to support the proposal?

6.1 Yes, with appropriate and viable levels of investment, the Council considers that the Abbey Railway Line does have the capacity to support the proposal. There has been a range of evidence over a period of time that supports this view, including most recently and comprehensively as set out at M7xiQ6 Appendix 1 – Abbey Line Passing Loop Feasibility. The study needs to be read as a whole to fully grasp the details, however the Executive Summary reproduced below sets out the key elements in a concise manner:

Executive Summary

After infrastructure simplification by British Rail, the 'Abbey line' between Watford Jc and St Albans Abbey has been limited for many years to a 45-minute frequency service, but this is sub-optimal for a railway operating in a largely-urban environment, and various suggestions have been made to overcome this. This report details work carried out to assess the technical and economic feasibility of installing a low-cost passing loop along the line, to enable the service to be improved to half-hourly. The project has been a collaborative effort, and the Railway Consultancy wishes to thank Abfly, ACoRP and local authorities for their support.

The context for renewed interest in improving the line is that, in addition to background rail demand growth, specific and substantial local developments are expected near the line, both near Watford Junction station and on the Radlett aerodrome site. Rail improvements also fit in to wider planning and transport policy objectives.

Our analysis identified Bricket Wood as the best location for a passing loop. In order to minimise costs, lengthening the existing platform there, to achieve a solution pioneered at Penryn in Cornwall, appears promising. We have developed a technical solution ("option E") which minimises signalling costs, subject to some operational constraints, and an increase in journey times of 3 minutes for passing trains. There is an 80% probability of the capital costs of this option being <£8.6m.

The major scheme benefit is in the reduction in passenger waiting times. Construction of a demand model covering the local area and 10 representative traffic sources/destinations elsewhere enabled us to estimate the value of this benefit, once the model had been calibrated on existing conditions, and demand growth from both background trends and the local developments added.

The increases in demand, revenue and time savings resulting from the passing loop were compared against the costs of achieving this. As well as the capital costs, significant operating costs are also incurred, notably in extra traincrew and trainsets. Scheme appraisal showed that the value of the scheme benefits was sufficient to compensate for the capital expenditure, but not the operating costs. A two-pronged strategy is recommended to address this issue, by seeking ways of reducing the operating costs, and other sources of funding income. Particularly promising for the latter are potential development gain monies from a large local housing development at Radlett Aerodrome.

However, the status of this passing loop project needs to compared to other local transport ideas, also designed to address the worsening transport problems of the area. Our quantification of costs and benefits associated with a proposed passing loop at Bricket Wood should enable this possibility to be considered appropriately against other, larger and thus-far less-enumerated suggestions, be those for road improvements of the development of a guided bus system. The feasibility study reported here also provides the evidence base on which to implement the passing loop improvement in a rather shorter timescale than many of the other options, so we recommend it for due consideration.

6.2 It can also be noted the level and range of support from those writing in the Foreword, namely:

Derrick Ashley
Chairman of the Abbey Line Community Rail Partnership
Hertfordshire County Councillor
Executive Member, Growth, Infrastructure, Planning and the Economy

Paul Webster
Operations Manager ACoRP

Peter Taylor
Elected Mayor, Watford Borough Council

Alec Campbell
Leader, St Albans City Council

6.3 It can also be noted that there is significant support for improvements to the capacity of the Abbey Line in HCC's Local Transport Plan 4; the A414 Corridor work and HCC's draft South West Herts Growth & Transport Plan.

6.4 It can be further noted that the Abbey Line capacity and service improvements set out in S6 were supported by HCC in their landowner / developer Annex 1 in summer 2018 and their Plan Regulation 19 Publication formal representations in October 2018.

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7. Question 7

What evidence is there to demonstrate that services would be increased? Can rail operators provide the increased peak period service sought?

7.1 As addressed in response to Matter 7xiQ6, evidence is set out comprehensively at M7xiQ6 Appendix 1 – Abbey Line Passing Loop Feasibility.

7.2 It can also be noted that there is significant support for improvements to the capacity of the Abbey Line in HCC's Local Transport Plan 4; the A414 Corridor work and HCC's draft South West Herts Growth & Transport Plan.

7.3 It can be further noted that the Abbey Line capacity and service improvements set out in S6 were supported by HCC in their landowner / developer Annex 1 in summer 2018.

7.4 Most recently, it can also be noted that HCC in its 4 December 2019 Cabinet report, regarding their updated Rail Strategy, sets out '…the following improvements are required… An upgrade to the Abbey Line to provide a frequency of at least 2 tph…increased frequency to 2 tph or 3 tph).

8. Question 8

Is the passing loop on the Abbey Railway line justified and deliverable?

8.1 As addressed in response to Matter 7xiQ6 and 7, evidence is set out comprehensively at M7xiQ6 Appendix 1 – Abbey Line Passing Loop Feasibility.

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9. Question 9

What is the likelihood of the direct rail services to Euston via Watford (or future extension to Metropolitan line to Watford) or an additional station on the Midland Mainline?

9.1 The Council's understanding is that both the direct rail services to Euston via Watford (or future extension to Metropolitan line to Watford) or an additional station on the Midland Mainline are technically possible, but with no specific agreed project or plan to bring them into being at this time. They are both potentially feasible and as the PSGV Broad Location is the key driver for these potential changes, their real likelihood of delivery will be known in more detail as the PSGV proposal progresses. In a virtuous circle, once the Local Plan is adopted, it will provide greater certainty to engage more deeply with the relevant stakeholders. That this engagement and concepts for delivery will take a considerable period of time and are not certain to result in deliverable proposals, the Council fully acknowledges. The Council further acknowledges that neither proposal is at all likely in the short term. However, there is a greater likelihood in the medium to long term once the Local Plan is adopted. That these are possibilities to be fully explored rather than shorter term specific deliverables, has been approached directly in the Plan with the specific wording chosen at S6xi:

23 Full exploration of possibilities for direct services to Euston via Watford and/or links to a future Metropolitan Line extension in Watford

…

25 Full exploration of possibilities for an additional station on the Midland Mainline

9.2 There are a number of specific factors that provide some evidential reassurance that these are possibilities worth exploring in the way set out in the Plan. These include the fact that it is understood that very high level feasibility work on Watford Junction station has indicated that there is the physical space to accommodate changes that would allow through trains. It is acknowledged that there are no current plans to do so. With regard to an additional station on the Midland Mainline, it is considered important to be aware that between 1905 and 1959 there was a station on what is now the Midland Mainline immediately adjoining PSGV Broad Location. This station was known as the Napsbury station or the Napsbury Halt. The basic technical requirements for a new station in terms of acceptable gradients and landform etc. for a new station have therefore been proven.

9.3 Given that these are clearly long term aspirations, it is also considered to be important to bear in mind that other SW Herts LPAs are likely to have significant growth locations in the general vicinity of both PSGV and Watford Junction stations. These adjoining new draft Local Plans are predominantly intended for Regulation 19 Publication in May 2020 (as addressed in more detail in response to other MIQs).

9.4 Further, given again that these are clearly long term aspirations, the Council considers that it is essential to fully explore such possibilities as climate change and overall development and transport sustainability becoming even more important over time.

9.5 It can also be noted that the majority landowner, HCC, supported these policies in the landowner / developer submissions in their Annex 1 summer 2018.

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10. Question 10

Should the policy refer specifically to the provision of sports facilities?

10.1 No, as also set out in the Councils response to M7i Q11, the Council considers that there is no requirement to set out specifically the provision of sports facilities in the policy here. Appropriate sports facilities will be required, but will most appropriately be identified in detail and secured through the mechanisms that the draft Plan already contains. This includes at S6 (xi):

S6(xi) – Requirement 1 - *Masterplanned development led by the Council in collaboration with local communities, landowners and other stakeholders*

S6 (xi) Requirement 9 - *A substantial new Country Park providing facilities for new and existing communities.*

S6 (xi) Requirement 18 - *Recreation space and other community facilities, including health provision*

10.2 This also includes at L22 'Community, Leisure and Sports Facilities'

"the provision of new community, leisure and sports facilities will be concentrated in the following locations;

…

- *As part of new Local Centres within Broad Locations for development and in other major developments*
- *As part of new educational development, where joint use facilities should be provided*

…

The council will encourage new and enhanced sport and recreational facilities in appropriate and sustainable locations, including in particular:

- *"New local provision as part of major residential development at Broad Locations, including possible joint use of education and multi-purpose community buildings / halls or improvements to existing parish halls / centres near to the new housing areas"*

10.3 This also includes at policy L28 'Green Space Standards and New Green Space Provision':

Creation of new green space through development or other opportunities will be directed at meeting needs for the new development and also addressing identified needs and deficiencies in the host settlement.

Priority provision at the Broad Locations (excluding provision of country parks / wildlife habitat creation areas – Policy S6) is set out in the Table below:

Broad location	***Priority provision***
Park Street Garden Village	*Strategic play* *Teenage areas* *Children's Play Areas*

	Parks and Gardens *Playing Pitches: adult and junior football* *Allotments* *Needs to be confirmed through Masterplanning Process*

10.4 It is noted that there has been an objection received by Sports England in relation to a lack of specific sports provisions identified in the draft Local Plan, as well as concerns with the robustness of the Playing Pitch Strategy Update 2019 (LCRT 002). The Council has been working closely with Sports England in recent months and is in the process of developing a new Playing Pitch Strategy for the District that will meet Sport England's concerns about the current version. This new document will include identifying more directly in line with current guidance and best practice the current shortfall in existing sports facilities, as well as additional requirements from projected population growth from the Broad Locations.

10.5 The new Playing Pitch Strategy will, through the Masterplanning and subsequent Planning Application processes be used to secure on site provision and appropriate contributions from S106 agreements. This new work has included working with other bodies, such as Herts FA and services within the Council to identify areas for potential improvement.

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8. Question 8

Is the site suitable for development in relation to flood risk?

8.1 Yes, the site is considered to be suitable for development in relation to flood risk.

8.2 The NPPF advises:

Planning and flood risk

155. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

156. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

157. All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change

158. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

8.3 In selecting strategic sites for Broad Locations, flood risk was taken into account.

8.4 The most recent Strategic Flood Risk Assessment (ENV 001) was undertaken jointly by Three Rivers District Council, Dacorum Borough Council, St. Albans City and District Council and Watford Borough Council.

8.5 The Broad Locations were assessed as part of the South Hertfordshire Level 1 SFRA.

Site Name	*Area (ha)*	*Flood Zones*					
		% in FZ 3b only	*% in FZ 3a only*	*Total % within FZ3*	*% in FZ 2 only*	*% in FZ 1 only*	*Total % within FZ 3a + 70% climate change*
West of Chiswell Green Broad Location	*15.12*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*
North of St Albans Broad Location	*41.97*	*0%*	*0%*	*0%*	*1%*	*99%*	*1%*

North East Harpenden Broad Location	*33.67*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*
West of London Colney Broad Location	*13.78*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*
East of Hemel Hempstead north	*66.94*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*
East of Hemel Hempstead sout	*59.36*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*
East of St Albans	*40.17*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*
North-West of Harpdenden	*18.16*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*
Former Radlett Aerodrome	*4.2176*	*0%*	*0%*	*0%*	*0%*	*100%*	*0%*

8.6 The Sustainability Appraisal considered the plan in terms of flood risk, under SA Objective 3 which is replicated below.

3. Ensure that new developments avoid areas which are at risk from flooding and natural flood storage areas.

- *To avoid developments in areas being at risk from fluvial, sewer or groundwater flooding (for instance natural flood plains) while taking into account the impacts of climate change*
- *To ensure that developments, which are at risk from flooding or are likely to be at risk in future due to climate change, are sufficiently adapted*
- *To promote properly designed and maintained sustainable urban drainage systems to reduce flood risk and run off and contribute to improved water quality, green and blue infrastructure and function.*
- *To take account of additional surface water generated by new development*
- *To seek opportunities for Natural Flood Management where appropriate.*

8.7 The St Albans Local Plan Sustainability Appraisal Report 2018 Non-Technical Summary (CD 011) shows that no significant effects have been identified with regard to flood risk and extracts are shown below.

	Reference Term	***SA Objective***	***Significant effects identified***
…	…	…	…
3	*Flood risk*	*Ensure that new developments avoid areas which are at risk from flooding and natural flood storage areas*	*No significant effects identified*

In relation to flood risk (SA objective 3), by seeking to avoid development in areas at risk from flooding, ensuring that water and flood risk are fully addressed by new development and requiring SUDS, including flood storage areas, to be incorporated into new developments (Policy L29 Green and Blue Infrastructure, Countryside, Landscape and Trees) there should be a positive effect against this objective. In addition, supporting the creation and enhancement of green infrastructure (also Policy SL29) which could provide for flood alleviation will also help support the achievement of the objective.

8.8 For the PSGV Broad Location, the SA Addendum (CD 012) indicates the following assessment.

Policy S6 xi) Park Street Garden Village Broad Location and Strategic Rail Freight Interchange							
SA Objective		***Assessment of Effect***					
		Nature of Effect *Including where appropriate whether the effects are direct/indirect and likely/unlikely.* ***Justification and Evidence***	*Permanence*	*Scale*	*Significance of*		
					In the short term	*In the medium term*	*In the long term*
…	…	…	…	…	…	…	…
3	*Flood risk*	***PSGV****: Approximately 7.5% of the site is in the flood risk zones 2 and 3 associated with the River Ver which runs through the north west corner of the site. There would therefore be a flood risk for new development. However, the Local Plan Policies Map indicates that the north-west area of the site is allocated for 'L18 Transport Strategy (improvements in Green Belt)' (of which approximately 25% is in flood zones). As the majority of the site is in the lower risk flood zone 1 the flood risk area could be avoided for new built development.* *The 2018 SFRA considers the implications of climate change:* • *It shows that none of the site lies in 'Flood Zone 3 + 70%CC'.* • *It identifies that some parts of the site are classified as 'RoFSW[1] + CC (1 in 100-year + 40% CC)'. These will need to be taken into account in future masterplanning and detailed design.*	***P***	***L***	***x***	***x***	***x***

8.9 Within the wider area of the Broad Location, there is a small area of flood zone 2 and 3 at a peripheral location, which is associated with the L18 Transport Strategy. As the vast majority of the Broad Location is within flood zone 1, the flood risk area could be avoided for new built development. The Masterplanning process, which is a policy requirement, will prevent the development of buildings at locations within the flood zone 2 & 3 and take account of areas affected by climate change; and will steer development to areas with a lower risk of flooding.

8.10 Annex 1 of the Local Plan shows that base capacity calculations have been undertaken, which are duplicated below. It can be seen that residential is calculated at 60% of the non-GB area; and non-residential accounts for 40%, which will include provision of green infrastructure and SuDs etc in accordance with policy. The wider Broad Location also contains additional land which is not removed from the Green Belt. Taken together with the small area affected, this provides confidence that the Broad Location has capacity to accommodate any flood requirements which will be subject of more detailed work during the Master Planning process.

Annex 1 - Broad Location (BL) Area and Base Capacity Calculations (in Hectares - Ha

Broad Location (BL)	***BL Wider Area (Ha) (Purple on Policies Map)***	***Broad Location Non-Green Belt Area (Ha) i.e. Area to be removed from GB***	***60/40 resi / non-resi split on BL Wider Area***	***60/40 resi / non-resi split on non-GB Area***	***New Education Site in GB up to (Ha)***	***Net developable area when education sites are in Green Belt - 80% of Non-Green Belt area***	***SADC net developable area for capacity calculations x 40 dwellings per hectare =***	***60/40 excluding school but including circa 1 Ha allotment site***
North West Harpenden	*22.3*	*18.2*	*13.4/8.9*	*10.9/7.3*	*2.8*	*14.5* See note below*	*14.5x40 = 581*	
North East Harpenden	*43.2*	*31.7*	*25.9/17.3*	*19/12.7*			*19x40 = 760*	
North St Albans	*46.7*	*46.7*	*28/18.7*	*28/18.7*			*28x40 = 1120*	
East St Albans	*116.9*	*52.5*	*70.1/46.8*	*31.5/21*	*22.2*		*31.5x40 = 1260*	
Park Street Garden Village	*186.0*	*97.7*	*111.6/74.4*	*58.6/39.1*			*58.6x40 = 2344*	
Chiswell Green	*15.2*	*15.2*	*9.1/6.1*	*9.1/6.1*			*9.1x40 = 365*	
London Colney	*38.1*	*13.8*	*22.9/15.2*	*8.3/5.5*	*24.5*	*11.0* See note below*	*11x40 = 441*	
East Hemel South	*138.8*	*115 (98 for calcs*)*	*76.3/50.9*	*59/39* See note below*			*59x40 = 2360*	
East Hemel North	*159.6*	*67.7*	*95.8/63.8*	*40.6/27* see note below*	*27.7*		*40.6x40 = 1624*	
North Hemel	*87.2*	*66.8*	*52.3/34.9*	*40.1/26.7*			*40.1x40 = 1604*	

Councils Response to Stage 1 Matters, Issues, Questions Thursday 12th December 2019.

9. Question 9

Is the approach to the primary and secondary schools on the site (in relation to the Green Belt) justified? Should their locations be identified?

9.1 Yes, the Council considers that the approach to the new primary and secondary schools on the site and their position in relation to the Green Belt is justified. For the avoidance of doubt, it is intended that the two primary schools will be located within the area removed from the Green Belt and that the secondary school and its playing fields may or may not, dependent on the Masterplanning process.

9.2 As set out in response to the closely linked Matter 4 Question 9:

9.1 Yes, in the context of this District at this time, the Council considers that the approach to secondary school sites in the Green Belt is justified. The District has 19 schools that currently lie within the Metropolitan Green Belt. This includes 8 secondary schools and 11 primary schools. There is no evidence that the location of existing schools in the Green Belt has unreasonably restrained their ability to evolve over time. Indeed, to the contrary, there have been numerous extensions, expansions and changes approved in recent years. Examples of these are set out below;

School	***Application Reference***	***Description of Development***
Sandringham, The Ridgeway, St Albans	*5/2018/1384*	*Two storey detached teaching block, extension to tennis courts, first floor extension to art block, two storey front extension to The Sandpit Theatre and synthetic flooring to outside warm-up area.*
	5/2017/1482	*All weather external 3G sports pitch and additional car parking*
	5/2016/1015	*Demolition of existing modular classroom and construction of replacement single storey drama studio*
	5/2014/0729	*Construction of a new two storey science/maths classroom block, extension to existing art/music block to provide one classroom, extension to existing library/teaching block to provide extended dining and office areas.*
Roundwood Park School, Roundwood Park, Harpenden	*5/2016/3228*	*Creation of artificial turf pitch with fencing, floodlighting, storage container and associated works*
	5/2010/0599	*New sports hall, including changing rooms and associated works*
Nicholas Breakspear RC School, Colney Heath Lane, St Albans	*5/2011/0592*	*Changing/teaching building and new multi-use games area with floodlighting to existing school playing field.*
	5/2003/2269	*Erection of single storey information centre with ancillary rooms and extensions to existing main entrance wing.*

9.2 HCC have consistently raised the example of a school in the Green Belt in the Three Rivers Core Strategy Examination, which the Council acknowledges. However, the situation with this Plan is fundamentally different and so a different approach is

justified. It is understood, in the Three Rivers case, that the location of the school build zone was known. A specific understanding of the impacts of amending the Green Belt boundary to accommodate the school building zones was therefore possible. An informed judgment regarding the 'exceptional circumstances', as explicitly required in the NPPF and case law to justify an amendment to the Green Belt boundary, could therefore be made. That is not the case with any of the schools proposed in the Green Belt in this Plan. Whilst overall areas accommodating the schools are known and set out, the position within them of the school build zones and the open space is not yet known. That work is being taken forward as part of Masterplanning and will be crystallised in forthcoming planning applications. The Council is very open to considering the matter again once this Plan is adopted and the school build zones are known, in a review of the Plan.

9.3 It is acknowledged that HCC have raised an objection on this issue and that they consider that the policy S3 should be amended in order to remove the school building zones from the Green Belt. It is also acknowledged that this has been HCC's position consistently when raised in DtC discussions and other meetings. SADC's position has also been clear and consistent over time and the authorities have effectively reached a position where they 'agree to disagree' on the issue.

9.4 As set out in S3:

Schools are a key element of infrastructure. They have been successfully provided and retained in the Green Belt in this District in numerous locations over many years. The largely open nature of such sites often makes an important contribution to the Green Belt.

9.5 As set out in the NPPF at paragraph 35:

*b) **Justified** – an appropriate strategy, taking into account the reasonable alternatives, and based on proportionate evidence;*

9.6 Overall, the Council considers that its approach is appropriate, taking into account the reasonable alternatives, in the specific context of the District and the evidence at this time.

Councils Response to Stage 1 Matters, Issues, Questions Thursday 12th December 2019.

10. Question 10

How have heritage assets been considered and is a Heritage Impact Assessment required?

10.1 The Council has directly considered heritage assets as part of the Strategic Site Selection process and the Sustainability Appraisal and in considering the draft Plan wording. The Grade 2 listed buildings and an appropriate buffer that respects their setting are proposed to be retained within the Broad Location.

10.2 The Strategic Site Selection process set out a three stage process of selecting the broad locations, with stage 2 setting out;

Stage 2

2. Suitability will set out as (Red Amber Green) if there are any issues which are overriding constraints to development – eg Access, Transport, Heritage, Biodiversity, Flood Risk. Any Red rating will rule a site out for further consideration.

10.3 The Sustainability Appraisal, sets out as part of the SA/SEA Objectives;

10. To identify, maintain and enhance the historic environment, heritage assets and their setting and cultural assets

10.4 In consideration of the Broad Location S6 xi) it was set out in the Sustainability Appraisal that;

There is uncertainty as to the effects on the 'historic environment' objective as a relatively small area near the western boundary of the site lies within the Park Street and Frogmore Conservation Area and there is a Grade II Listed Building (Toll Cottage, Burydell Lane, Park Street) in the same area of the site. The settings of these heritage assets may be affected by any new development, although the topography and existing screening should minimise any adverse effects. Development could also affect the settings of the 'Colne Chapel moated site' Scheduled Ancient Monument and Napsbury Park which is designated as a Registered Historic Park and Garden and a Conservation Area – both of which are on the other side of the railway to this site.

10.5 Historic England has raised objections to the Plan, highlighting the lack of evidence to demonstrate that appropriate considerations have been given to the conservation and enhancement of the historic environment, together with a lack of policy criteria for the protection and enhancement of the historic environment in relation to these large sites. In the Councils response as set out in Regulation 22C;

"Cross reference Policy L30 This supports conservation of heritage assets appropriate to their significance and seeks that development which may affect such assets is accompanied by a Heritage Statement. Such heritage assets form only a small proportion of the overall Broad Location, are acknowledged and will be treated appropriately as part of the Masterplanning / planning application processes."

10.6 A specific Heritage Impact Assessment is not considered to be required at this Plan-making stage. A Heritage Statement and a Heritage Impact Assessment will be required as part of the Masterplanning and planning application processes. These Heritage considerations have already and will continue to inform the ongoing Masterplanning being taken forward through the PPA process (see other MIQ responses).

Councils Response to Stage 1 Matters, Issues, Questions Thursday 12th December 2019.

11. Question 11

Has consideration been given to air quality and any mitigation measures?

11.1 Yes, the Council has given consideration to air quality and mitigation measures.

11.2 The main references in the NPPF are:

9. Promoting sustainable transport

…

103. The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making.

…

15. Conserving and enhancing the natural environment

…

181. Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.

11.3 With regard to air quality, promoting sustainable transport and limiting the need to travel are key factors. Actively managing patterns of growth in support of these objectives has involved planning for sustainable communities, and it this approach which underpins the Local Plan. It should be noted that the Local Plan sits within a wider range of initiatives within the County and District which relate to air quality including: Air Quality Action Plan, Climate Change Action Plan 2016 and the Green Travel Plan.

11.4 The main issues with regard to air quality in the District are transport related. The AQMAs for SADC are listed below. LAQM Annual Status Report 2018 states '*This general trend in concentration reduction from 2013 to 2017 could be due to the continual commitment and progress made by the St Albans City and District Council to improve local air quality with the aim to revoke the declared AQMAs.' Please see* extracts from the LAQM Annual Status Report 2018 below. Table 2.2 which shows 'Progress on measures to improve air quality' can be found at M7xiQ11 Appendix 1.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan
						At Declaration	Now	Name
St Albans AQMA No. 1	Declared 02/11/2004, and amended in 08/07/2009	NO2 Annual Mean	St Albans	The area comprising of odd numbers 1-7 London Road, 1-11c Holywell Hill and even numbers 2-38 London Road, St Albans.	NO	61µg/m3	41.2µg/m3	Air Quality Action Plan for St Albans City and District Council
		PM10 24 Hour Mean				-	-	
St Albans AQMA No. 2	Declared 02/11/2004	NO2 Annual Mean	St Albans	The area comprising of Beechtree Cottages, Hemel Hempstead Road, St Albans (adjacent to junction of M1 (J7) and M10).	YES	52µg/m3	36µg/m3	Air Quality Action Plan for St Albans City and District Council
St Albans AQMA No. 7	Declared 21/09/2004	NO2 Annual Mean	St Albans	An area encompassing a number of domestic properties in Frogmore on Radlett Road and Colney Street in the vicinity of the M25.	NO	44µg/m3	36µg/m3	Air Quality Action Plan for St Albans City and District Council

Conclusions and Priorities

The priorities for the coming year include continuing to work with the Air Quality Action Plan (AQAP) measures, implementing the actions that are ready for completion and working with separate departments within St Albans City and District Council on measures benefitting air quality within the Climate Change Action Plan 2016, the council Green Travel Plan and the Hertfordshire County Council Local Transport Plan 2011 – 2031. The good work already undertaken in relation to the reduction of vehicle idling and to explore new options for promotion and enforcement of anti-idling will continue.

11.5 HCC LTP4 includes the following policies which provides the context within which the Local Plan Policy L18 Transport Strategy sits. The GTPs provide further information about sustainable transport initiatives. LTP4 sets out:

Policy 1: Transport User Hierarchy
To support the creation of built environments that encourage greater and safer use of sustainable transport modes, the county council will in the design of any scheme and development of any transport strategy consider in the following order:

- *Opportunities to reduce travel demand and the need to travel*
- *Vulnerable road user needs (such as pedestrians and cyclists)*
- *Passenger transport user needs*
- *Powered two wheeler (mopeds and motorbikes) user needs*
- *Other motor vehicle user needs*

…

Policy 19: Emissions reduction

The county council will reduce levels of harmful emissions by:

a) Promoting a change in people's travel behaviour to encourage a modal shift in journeys from cars to walking, cycling and passenger transport.
b) Addressing any barriers to and supporting the uptake of ULEVs in the county, particularly where this can positively affect areas with identified poor air quality….

…

Policy 20: Air Quality

The county council will seek to reduce the impact of poor Air Quality on human health, by:

a) Investigating the use of Clean Air Zones.
b) Working with district/borough councils to monitor and assess air pollution levels, and working in partnership with them to deliver any declared AQMA joint action plans.
c) Implementing, monitoring and reviewing the county council's Air Quality Strategic Plan.

Outcomes

These policies in conjunction with other LTP4 policies seek to reduce Hertfordshire's contribution to greenhouse gas emissions and global climate change, and also reduce the contribution of transport to poor air quality which impacts human health, flora and fauna.

Relevant Supporting Documents

- *Active Travel Strategy*
- *Intalink Bus Strategy*
- *Network Management Strategy*
- *Growth and Transport Plans*
- *Air Quality Strategy*

11.6 The District Local Plan Policy L18 Transport Strategy sits within the framework provided by LTP4 and embeds the LTP4 principles. Some extracts from Policy L18 overall approach is set out below together with reference to 'air quality' in the policy. It is considered that these broad principles provide the foundation of addressing air quality as it relates to transport.

Overall Approach

The policies embedded throughout this Local Plan work in conjunction with HCC and HE led transport planning. Together, they will provide relevant sustainable transport infrastructure and approaches which promote sustainable modes and create a foundation for enabling significant changes in travel behaviour. They encourage and enable shorter journeys to be made by sustainable means, including by walking and cycling, given the wider community benefits of active travel…

The Broad Locations for Development (Policy S6) have been selected in part on the basis of their potential to offer opportunities to achieve sustainable travel outcomes. New school

locations have also been selected in part on the basis of their potential to offer opportunities to achieve sustainable travel outcomes….

Particular consideration will be given to planning for…

- *reductions in transport-related emissions and improvement to air quality. This should include measures to improve air quality along major roads, including enabling the removal of Air Quality Management Area (AQMA) designations…*

Transport impacts on air quality
Planning for major development must include an assessment of air quality impacts from traffic (both from the development and on occupants of the development).
Development design and the transport measures associated with the development must include proposals to limit and mitigate impacts. This is particularly the case if there is an effect on a designated Air Quality Management Area (AQMA).

11.7 The SA Report includes SA Objective 7 which seeks to 'Achieve Good Air Quality' and the related criteria is set out below:

7. Achieve good air quality especially in urban areas

Criteria: To reduce the need to travel by car through planning settlement patterns and economic activity in a way that reduces dependence on the car and maintains access to work and essential services for non-car-owners

- *To integrate land use and transport planning by for instance:*
  - *Promoting Green Transport Plans, including car pools, car sharing as part of new developments*
  - *Ensuring services and facilities are accessible by sustainable modes of transport*
  - *To ensure that development proposals do not make existing air quality problems worse*
- *To address existing or potential air quality problems*
- *To avoid siting developments that would be sensitive to air quality issues in areas with poor air quality*

11.8 With regard to air quality objective, the SA indicates that no significant effects have been identified for the plan. Please see extracts from the SA Report NTS (CD 011) set out below.

Table 1: Framework of SA/SEA Objectives

SA/SEA Objectives
…
7. Achieve good air quality, especially in urban areas

5.3.5 Air quality (SA Objective 7)
Transport is a key source of air pollution. The provision of new housing and economic development, combined with that in neighbouring local authorities, will contribute to background emissions through an increase in vehicles on the road therefore having an adverse effect on air quality. However, similar to greenhouse gas emissions, focusing housing and economic development in the main settlements and making developments accessible should help to reduce the need to travel and the average distance travelled which should help to reduce growth in airborne emissions. In addition, as the overall vehicle fleet is replaced over time by new vehicle types with reduced levels of pollutant emissions, as well as electric vehicles, so air quality should improve accordingly.

Encouraging the use of more sustainable modes of transport such as walking, cycling and passenger transport over the use of private car (Policy L18 Transport Strategy) as well as requirements to improve walking and cycling links at the .. broad locations should have a positive effect on reducing pollutants from transport.

11.9 With regard to mitigation measures, the PSGV area is set to improve in terms of sustainable travel infrastructure. The PSGV development is also considered essential to the delivery of LTP4 strategic transport schemes and securing significant sustainable travel outcomes in this part of the District. The schemes would be strategically located within the Hertfordshire transport network and would secure benefits for the County which extend beyond the Broad Location. The improved sustainable transport infrastructure is expected to increase the proportion of journeys undertaken by sustainable travel and active travel. Key references are listed below:

- The Broad Location will deliver LTP4 scheme for corridor 4 '*Working in partnership with Network Rail and Train Operating Companies to bring forward … short to medium term service improvements on the Abbey Line as detailed in the LTP4 Rail Strategy.'* The Broad Location is also key to the delivery of LTP4 scheme A414 Bus Rapid Transit in this part of the District.
- The South West Herts GTP (INFR 001 IDP ref 78 on p169) has considered sustainable travel for the PSGV area and has identified sustainable transport initiatives. Please see extract below. The initiatives are also listed in COMET LP4 SADC Analysis V4 Final (INFR Oct 2019).
- PSGV would benefit from transport improvements listed in Policy S6xi including: (*14) New park and rail facility on the Abbey Railway Line south of the A414 and (15) 15-20 minute peak period service on the Abbey Railway Line ….*
- Policy S6 xi (25) *Full exploration of possibilities for an additional station on the Midland Mainline*. Potentially the work could result in a new station for London Colney in the future (located on PSGV boundary), which would represent a step change for transport infrastructure provision in the area, albeit beyond the plan period.
- The A414 Corridor Strategy (Public Consultation Draft 2018) includes proposals for the PSGV area. A range of initiatives have been identified for segment 5, segment 6 and segment 7. (see extract below)The future introduction of a MRT along the A414 with provision of a new MRT interchange nearby would provide a step change in transport infrastructure for this area, albeit beyond the plan period.

SWH GTP Extracts:

Ref		***Scheme or Project Name***	***Concept description***
SM13a	***Alternative approaches***	*Abbey Line Park & Rail Hub: Extension of Park Street Station platform*	*Extension of Park Street station platform northwards to facilitate the introduction of a Park & Rail hub south of the A414. Vehicle access provided off the A414 at a new at-grade junction.*

Herts Cross-County Mass Rapid Transit
HCC's LTP4 highlights the opportunity to provide a high quality bus rapid transit system across the County. Such a system would be integral to the viability of some of the Packages and interventions put forward in this GTP, including new edge of town multi-modal interchanges.

Abbey Line

The Abbey Line provides a vital link between Watford town centre and St Albans and also connects communities along the corridor such as Park Street and Garston. The Abbey Line has potential as an attractive alternative to travelling by car on congested parallel roads. Potential approaches to improve service frequency on the Abbey Line include implementing a passing loop along the line to enable two trains to operate in opposite directions or, in the longer term, conversion to an alternative transport system if this were to offer significant improvement to local connectivity. These options would need to be explored in more detail in discussion with all relevant parties. HCC's objectives and priorities are set out in the HCC Rail Strategy.

COMET LP4 SADC Analysis V4 Final (INFR Oct 2019) Extract:

Package	Location	Scheme Code	Scheme Details	Scheme Details	Indicative Commentary on Schemes from LP4
…	…	…	…	…	…
PK31	London Colney Inter-Urban Strategic Public Transport Connectivity	SM183	London-Colney Railway Station	London-Colney Railway Station – Investigate a long term aspiration for a new railway station on the Midland Mainline served by Thameslink rail services, comprising of 2 platforms on the "slow" tracks only or 4 platforms (to mirror the provision at all other MML Thameslink stations). Station would be served by all "stopping" Thameslink services between Luton/St Albans and London (and beyond) and could potentially be served by some or all fast Thameslink services. This would require extensive consultation with DfT, Network Rail and rail operators to determine operational feasibility and a favourable business case which will confirm if there is a need and it presents good value for money. New link road to London Colney will be required, incorporating a lit, shared footway/cycleway and some parking (the amount of parking will need to be determined). Station could be located broadly west of London Colney.	This scheme would be post 2036, but is desired by SADC. Providing a viable rail alternative between St Albans and London Colney (plus other locations in St Albans District) could help reduce car trips.

A414 Corridor Strategy Extracts:

A414 Package 6 - South of St Albans and London Colney		
Name	***Short Description***	***Cost***
…	*…*	*…*
A414 Cycle Route upgrade Park Street-London Colney	*Improve the cycle track alongside the A414 between the Park Street and London Colney Roundabouts.*	*£50k - £500k*

Mass Rapid Transit—Route B Watford-Welwyn Garden City via A405 Garston, Bricket Wood, How Wood, Park Street, London Colney & Hatfield		
Component ID	***Description***	*Cost*
MRT-RB1	*Park Street Hub with associated connections to the A414*	*£5m - £10m*

A new transport interchange associated with a Mass Rapid Transit, located adjacent to the A414 and Abbey Line, needs to be well connected with its surroundings. Access will need to be gained by road via the A414, and hence a new junction on the A414 will be required. This would need to facilitate the movement of MRT services into and out of the interchange as well as potentially private cars (for drop-off/pick-up). …. The interchange will also need to be reached on foot and by bike.…

In relation to the surrounding area, there is the prospect of additional housing growth around Park Street in terms of a potential new Garden Village….

New developments will generate new travel demands on the surrounding transport network. The ambition would be for as many of the trips by future residents and employees to be undertaken by more sustainable modes, otherwise surrounding roads such as the A405 and A414 could become more overloaded. A Mass Rapid Transit incorporating an attractive interchange north of Park Street, with high quality links on foot and by bike could be key to enabling future residents to make journeys by more sustainable modes.

11.10 11.11 Mitigation is also provided in terms of on-site provision associated with a Garden Village proposal, such as: primary and secondary schools; neighbourhood and local centres; other community facilities such as recreational space and health provision. These will provide a wide range of services and facilities available within walking distance of new homes and make the Broad Location more self-contained; thereby facilitating active travel and reducing the need to travel longer distances.

11.11 11.12 With regard to PSGV Broad Location, page 70 & 71 of St Albans Local Plan Sustainability Appraisal Report 2018 (CD 009) sets out:

5.2.2.14 Policy S6 xi) Park Street Garden Village Broad Location

Mixed positive and negative effects have also been identified for the 'air quality' objective. The positive effects relate to the fact that the site is relatively accessible to some services, facilities and open space, which should help reduce the need to travel and minimise increases in airborne emissions. Development of new neighbourhood and local centres will further support this. In addition the site is next to a rail station with direct connection to

Watford & St Albans. In addition the rail-related improvements that would be associated with this site could help to reduce car usage and limit the increase in airborne emissions in the wider sub-region. The negative effects relate to the site being located some distance from the city/town centres which will result in additional vehicle trips with associated airborne emissions. In addition development in this location could exacerbate air quality issues in 'St Albans AQMA No.3' which encompasses a number of domestic properties in Frogmore on Radlett Road and Colney Street in the vicinity of the M25.

Positive effects have been identified for the 'sustainable locations' objective, as whilst this site is located some distance from the city/town centres there are new neighbourhood and local centres planned as part of the development which will meet some day to day needs and help reduce the need to travel. In addition the development could provide rail improvements which could be used by new and existing residents and provide opportunities to avoid car use.

Significant positive effects have been identified for the 'greenhouse gas emissions' objective as the potential scale of development would require the provision of a range of facilities and services in the new neighbourhood and local centres (e.g. schools and shops) thereby reducing the need to travel for many day to day needs. This would help reduce the growth in greenhouse gas emissions that would inevitably result from any new development. In addition, the site is next to a rail station with direct connection to Watford & St Albans. In addition the development would be required to provide a new park and rail facility, as well as exploring opportunities for other rail related enhancements, all of which would provide alternatives to private car use. Minor negative effects have been identified for the same objective as this site is located some distance from the city/town centres (St Albans and Watford) which will result in increased car use and growth in the level of greenhouse gas emissions.

12. Question 12

What is the justification for the two 15 pitch Gypsy and Traveller sites here? Should their precise locations be identified?

12.1 The justification is for the proposal is explained in detail in the response to M5 Q7-18, especially at M5Qs8 and 14. It is not considered necessary or appropriate to identify a specific location in the LP (Policies Map). The collaborative Masterplanning process required under Policy S6 is considered the right place to set out the necessary specificity with regard to the site location. This allows the proposal to properly evolve and take account of the detailed public engagement activities required (including through the Strategic Site Masterplanning Toolkit). In the Plan, the BLs establish essential planning and infrastructure requirements and explicitly do not resolve detailed site planning issues, as they are not considered to be required at this stage.

Councils Response to Stage 1 Matters, Issues, Questions Thursday 12th December 2019.

Matter 7 – The Broad Locations for Development – Specific Matters (Policy S6 (i) to (xi)

Park Street Garden Village S6 (xi)

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Strategic Local Plan Background Note

Residential Density

October 2014

St Albans City & District Council

Background Note

Residential Density

An earlier version of this note was considered by the Council's Planning Policy Committee on 3 July 2014. This version provides additional examples. The purpose of this Note is to illustrate housing density on some well known sites across St Albans City and District and thus to give a range of comparators for typical residential layouts / designs.

Measuring housing density is a simple way of quantifying the intensity of residential development and efficiency in use of land for housing. The measurement also gives some insight into the environmental character of housing areas.

The Note gives local examples of:

Relationship between gross and net density in recent major residential development

1. Jersey Farm; 1980's
2. Hill End / Cell Barnes; 1990s
3. Napsbury; 1990 / 2000s

Net density calculations

1. New England Street area, St Albans
2. King Harry Lane (new development in progress), St Albans
3. Jersey Farm Estate, St Albans
4. Oaklands Smallford Campus (current housing application as proposed), St Albans
5. Former Oaklands College City Campus housing redevelopment, St Albans
6. Part of Marshalswick Estate, St Albans
7. Part of Chiswell Green
8. Luton Road area, Harpenden
9. Belmont Hill, St Albans
10. Elm Lawns Close, St Albans
11. Land Rear of Sandridge Road, St Albans
12. Waverley Road, St Albans
13. St Albans Hospital site
14. Station Road, Harpenden (a)
15. Station Road, Harpenden (b)
16. Redbourn Lane, Harpenden
17. Luton Road, Harpenden

Calculation and interpretation of residential density

Decisions on what housing density is appropriate for a location are influenced by many different factors.

Building height, block size and housing typology are the main factors that influence the character of an area and perceptions of density.

However, higher density does not have to mean tall buildings with small apartments that fail to relate to local character. In fact, high buildings can be less effective in maximising the use of land, especially in terms of the relationship of developed and open areas.

Good design is crucial to achieve environmental quality. Each design scheme should establish the density appropriate for a particular location taking into consideration factors such as:

- Context - density appropriate to context and allowing respect for surrounding residential character
- Quality of public realm - a legible and stimulating public realm
- Outdoor space - high quality communal space
- Private and public space mix - ability to manage spaces
- Parking - adequate and appropriate car parking levels which do not dominate or detract from the external environment

Additional factors which might determine an appropriate density level include:

- Surrounding built form
- Housing types
- Need for different types of housing
- Need to create variety of densities – density mix
- Capacity of facilities for residents

It is important to remember that density is a product of design, not a determinant of it. Residential density should aim to support local infrastructure such as shops, schools, and local transport. Homes and Community Agency (HCA) “research has shown that there is no correlation between urban quality and density. Developments driven by average densities and shaped by blanket standards (relating to privacy, open space, parking and highway geometry, for example) stultify design and tend to produce lowest-common-denominator blandness.”

In the St Albans City and District Strategic Local Plan (SLP) the factors of what ‘housing types’ and the ‘need for different types of housing’ are particularly important. The draft SLP says: “All new housing development will contribute to a mix of different housing types in residential areas, taking into account the existing pattern of housing in the area, evidence of local need and site specific factors. It will in particular require the inclusion of more small and small to medium-sized housing, including one and two bedroom flats and 2

bedroom houses, in new development schemes in suitable locations, to increase the proportion of such sized units in the district housing stock, to widen choice and to provide more relatively low cost market housing available to buy. Floorspace, as well as room numbers and bedroom numbers, will be considered in judgments of relatively low cost market housing.

The Council requires the affordable housing size, type, and mix to broadly reflect that being provided for the market element of all development.

The Council seeks the provision of a reasonable proportion of housing designed to the lifetime homes standard that can be readily adapted to meet the needs of older people and people with disabilities.

Sheltered housing and extra care housing for older people and those with special needs will be encouraged on suitable sites in areas close to a range of services.

Further detail on requirements for appropriate housing size, type, mix and proportion of lifetime homes will be given in the DLP. “

Measuring density

There are different ways of measuring density, each of which provides different information.

They include:

- Dwellings per hectare (DPH) – this a common measure to indicate residential density. However, apartments at 60dph may actually have smaller built volume than larger houses at 30dph with related garaging.

- Square meters per hectare – measuring amount of floorspace per hectare is another method to illustrate development intensity. It indicates more clearly how efficiently land is being used.

- Floor area ratio (FAR) or plot ratio – this measurement express the ratio between gross floor area and site area. It again indicates the intensity of land use and gives some indication of massing volumes.

- Bedspace per hectare – measuring bedspace per hectare indicates population capacity rather than actual use (as some dwellings may be under-occupied.)

- Habitable rooms per hectare – habitable room and bedspace densities give an indication of resident population and a calculation of population capacity. Calculating habitable rooms per hectare can be helpful in

determination of likely demand for amenities and services such as public transport.

For the purpose of this Note the simple dwellings per hectare has been adopted.

The first part of the Note illustrates how density is viewed at a gross level. It gives examples of the relationship between gross and net density calculations. Gross density calculations can be used to estimate and illustrate the potential development capacity of a site. The Green Belt Review Part 2 (SKM Enviros Consultancy Study) used the approach that up to 60% of the Gross Development Area (GDA) would be developed (termed Net Development Area) and the remaining 40% would be required to provide infrastructure, main roads, open space and public facilities.

The second part of the Note illustrates calculations of net density. A net density measurement includes access roads within the site, private garden spaces, car parking areas, incidental open space and landscape and children's play areas but normally excludes major distributor road, primary schools, opens spaces serving a wider area and significant landscape buffer strips.

Net density is the measure of density used for the SKM recommended net development areas and thus is a comparable measure to that used in the illustrations in this Note.

Work on density assumptions in the draft Strategic Local Plan (SLP) is based on HCA research, in the form of a density matrix (Table 3.3 from the Homes and Communities Agency Urban Design Compendium – reference below). The matrix links typical residential densities to urban form ('creating urban structure'). It draws on examples of development across the UK and Europe. Average densities are based on case studies analysed as part of the *Sustainable Residential Quality: Exploring the housing potential of large sites* research. The matrix recommends that residential densities of 30 to 50 DPH (alongside related services) should be applied in suburban locations. This is considered to be relevant to the SKM identified sub areas assessed for the draft SLP, as they are located on the edges of existing settlements and exhibit suburban characteristics.

Illustrative areas analysed for the purpose of this study can be considered in the context of the Density Matrix.

The matrix is reproduced below:

		Option 1	Option 2	Option 3
Car Parking Provision		**High** 2-1.5 spaces per unit	**Moderate** 1.5-1 space per unit	**Low** less than 1 space per unit
Redominant Housing Type		**Detached & linked houses**	**Terraced houses & flats**	**Mostly flats**
Location	**Setting**			
Site within Town Centre 'Ped-Shed' (Accessibility index 6–4)	**Central**			240-1100 hr / ha 240-435 u / ha Ave. 2.7 hr / u
	Urban		200-450 hr / ha 55-175 u / ha Ave. 3.1 hr / u	450-700 hr / ha 165-275 u / ha Ave. 2.7 hr / u
	Suburban		240-250 hr / ha 35-60 u / ha Ave. 4.2 hr / u	250-350 hr / ha 80-120 u / ha Ave. 3.0 hr / u
Sites along Transport Corridors & Sites close to a Town Centre 'Ped-Shed' (3–2)	**Urban**		200-300 hr / ha 50-110 u / ha Ave. 3.7 hr / u	300-450 hr / ha 100-150 u / ha Ave. 3.0 hr / u
	Suburban	150-200 hr / ha 30-50 u / ha Ave. 4.6 hr / u	200-250 hr / ha 50-80 u / ha Ave. 3.8 hr / u	
Currently Remote Sites (2–1)	**Suburban**	150-200 hr / ha 30-65 u / ha Ave. 4.4 hr / u		

Table 3.3 Density matrix

Average densities are based on case studies analysed as part of the *Sustainable Residential Quality: Exploring the housing potential of large sites* research (LPAC, DETR, GOL, LT and HC, 2000)

(Note: This table is a direct extract from Homes and Community Agency Urban Design Compendium 1. Second row in column one should read 'predominant'.)

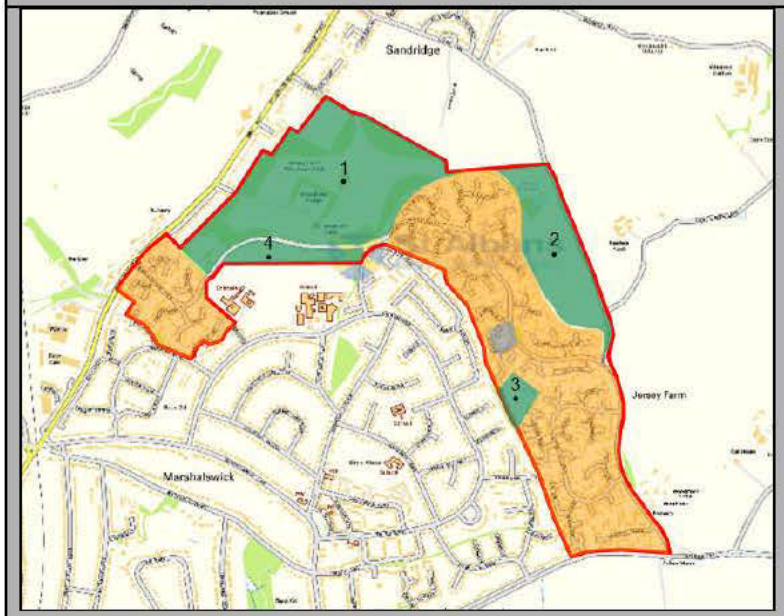
Reference:
Urban Design Compendium 2 (2007), *Delivering Quality Places* (2nd Ed), Homes and Community Agency

Relationship between gross and net density in recent major residential development – local examples

.

All figures are estimated / rounded (details noted below)

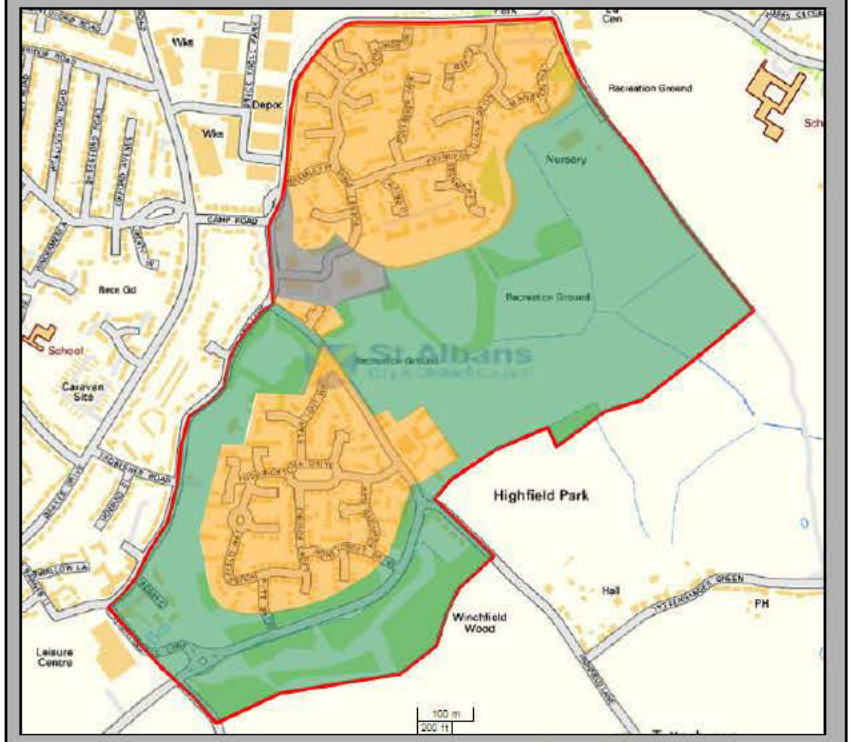
1. **Jersey Farm 1980s**

JERSEY FARM	Total area of development (Ha)	Area used for infrastructure (Ha) (mainly large open spaces, distributor roads and school sites)	Remaining area for residential development (Ha)	Dwelling numbers	Notes on assumptions / estimates
	102 ha	44 (**43%**)	58 (**57%**)	1800	• Infrastructure taken as including schools (see below), local centre (1 Ha) woodland park / schools (32 ha) eastern OS (9.5 Ha) local centre OS (1.5 ha) • Above area used for infrastructure includes approximately 25% of Wheatfields and Sandringham school sites to reflect use and expansion for the Jersey Farm estate (albeit this site

 Site boundary Developed area Undeveloped area 1. Woodland Park OS 2. Eastern OS 3. Central OS 4. Part of school site OS Local Centre					is pre existing and also serves Marshalswick) • Area used for infrastructure is probably an underestimate as, for ease of calculation, parts of the distributor road corridor and Jersey Lane are not included because they would require micro level area measurement • Dwelling numbers are estimated as Census super output lower level areas (SOAs 007C, 007B, 008A) and address point area adjustment. SOAs do not co-incide exactly with the estate to the NW corner. A cautious adjustment has been used
Density calculations - dwellings per Ha (dph)	**Gross** 1800 dwellings on		**Net** 1800 dwellings on		

	102 Ha = **18 DPH**		58 ha = **31 DPH**		

2. Hill End / Cell Barnes 1990s

HILL END / CELL BARNES (HIGHFIELD)	Total area of development (Ha)	Area used for infrastructure (Ha) (mainly large open spaces, distributor roads and school sites)	Remaining area for residential development (Ha)	Dwelling numbers	Notes on assumptions / estimates
	78 ha	46 ha **59 (%)**	32 ha **41 (%)**	800	• Infrastructure taken as including local centre (1.8 Ha), Highfield Park recreation areas (26 Ha) and Winchfield Wood OS (13.4 Ha). Full map of the Highfield Park facilities can be found here. The remainder is general open space and community facilities. • Dwelling numbers are estimated from Census super output lower level areas (SAOs) 015A and 015B and address point data

 					adjustment. SAO 15B covers Tyttenhanger Village and parts of Colney Heath Lane schools.
Density calculations - dwellings per Ha (dph)	**Gross** 800 dwellings on 78 Ha = **10 DPH**		**Net** 800 dwellings on 32 ha = **25 DPH**		

3. Napsbury 1990 / 2000s

NAPSBURY	Total area of development (Ha)	Area used for infrastructure (Ha) (mainly large open spaces, distributor roads and school sites)	Remaining area for residential development (Ha)	Dwelling numbers	Notes on assumptions / estimates
	60 ha	37 ha **62 (%)**	23 ha **38 (%)**	620	• Infrastructure taken as all large blocks of open space forming the setting for the residential development (37 Ha in all). These include distributor road and some small scale recreation facilities. • Area residentially developed is quite low and includes considerable additional integral amenity open space. This is due to the special character of this historic psychiatric hospital site; recognised in its conservation area designation. The

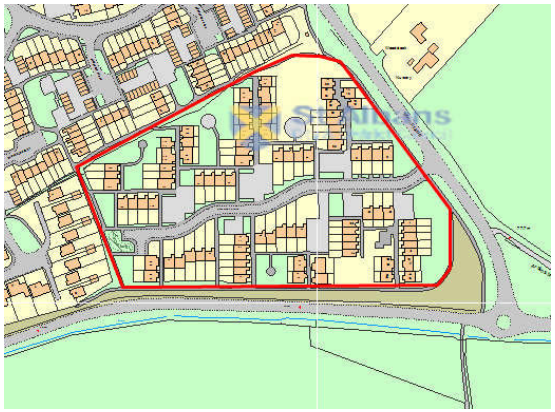
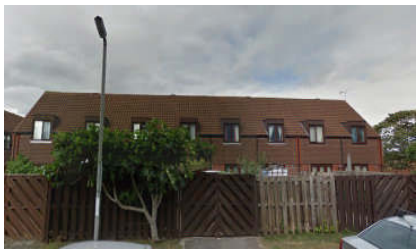
 Site boundary Developed area Undeveloped Area					design context set was in the importance of maintaining the extensive parkland setting
Density calculations - dwellings per Ha (dph)	**Gross** 620 dwellings on 60 Ha = **10 DPH**		**Net** 620 dwellings on 23 ha = **27 DPH**		

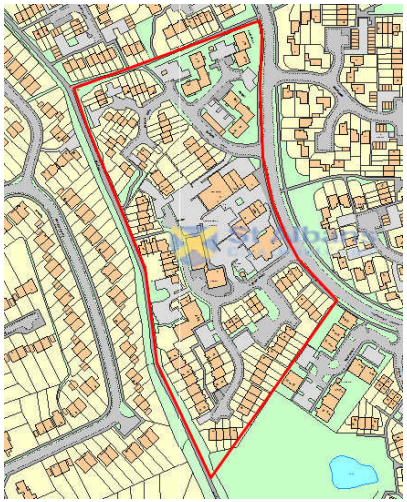
Net density calculations – local examples

1. New England Street area, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Land enclosed by New England Street to the West, Verulam Road to the North and College Street to the South, St Albans This is a residential area with primarily 2 storey cottage terraced houses built in the 19th Century. Additional residential development took place at the beginning of 20th Century along Verulam Road. The site includes two commercial units and a social use with small pockets of open space.	 	 New England Street  Temperance Street  College Street	The site is 2.5 ha in area and there are 144 dwellings within the site. Net density of this site is **57 DPH.**	Some of the space adjoining New England Street has been included in the calculations to illustrate the density with a reflection of the character of the area including some public space. A major factor in high density is total reliance on-street parking.

2. King Harry Lane (new development in progress), St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
The development of this site is divided into two phases. Phase one (northern side) is a proposal for 126 dwellings (16 key worker units, 45 extra care/assisted living units and 65 units of accommodation for the over 55s). Outline planning permission for phase one development was granted on appeal in February 2008. Phase two (immediately to the south of phase one development) is a development of 150 dwellings (ranging from 2 – 2.5 storey houses) Permission for this development was granted on appeal in April 2010.	 	 Illustrative Masterplan for phase one development.   Mortimer Crescent (phase two)	The site is 7.8 ha in area the total number of proposed dwellings is 276. Based on these figures, net density for the whole site is **35 DPH.**	This is illustrative of a recently permitted development in a suburban location but including some open spaces. Each site has different ownership but both sites share access arrangements and a coordinated design led approach.

3. Jersey Farm Estate, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Various parts of Jersey Farm Estate. The development of the whole estate took place across 1970s and 80s. <u>Area 1 – North – eastern part of Jersey Farm.</u> Permission for development of this site was granted in early the early 1980s.	.  	 Lincoln Close  Pirton Close  Sandringham Crescent	Area 1 The site is 6.8 ha in area and there are 156 houses within the site. Net density of this area is **23 DPH.**	The site consists of 2 storey detached houses. Average plot size is 300 to 350 m2. All the houses have garages and off street parking. .

<u>Area 2 – Southern part of Jersey Farm</u> This part of Jersey Farm Estate development consists mainly of 2 storey terraced houses. Permission was granted for the development of 118 Dwellings (60 flats and 58 homes) in the 1970s.	 	 Newgate Close  Newgate Close  Newgate Close	Area 2 The site is 2.8ha wide and there are 88 terraced houses within the site. Net density for this site is **31 DPH.**	Houses are set back from the street and have relatively large front and back gardens. There is a significant amount of designated resident parking space and pockets of green open space which explains the relatively low density for a development of terraced housing.

<u>Area 3 – Middle part of Jersey Farm</u> This is a mixed use area which includes residential dwellings, commercial and community uses Permission for the commercial Village Centre Development was granted in the late 1970s followed by approval for adjoining residential development in the early 80s.	 	 Harvesters  Twyford Road  Commercial Centre	Area 3 The site in total is 3.5 ha in area. Within the site there are 92 terraced houses, three blocks of flats (equivalent of 42 flats in total) and commercial centre (0.6 ha) which includes neighbourhood supermarket, five small retail units, public toilets, medical and community centre. After taking away the volume of commercial centre area and its parking, the net density for the site is **46 DPH.**	This relatively high density can be explained by the high proportion of terraced housing and flats. Dwellings of this kind are often included in the design of a central area or local centre within a settlement and this will allow higher overall densities to be achieved. It also introduces variation in the character of the built environment.

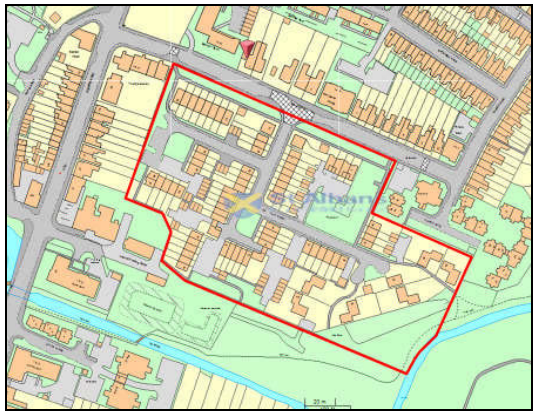
4 Oaklands Smallford Campus (current housing application as proposed), St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
A full application for comprehensive redevelopment to provide new and refurbished College Buildings and residential development of 348 dwellings, car parking, associated access and landscaping was submitted in May 2013. The application is still under consultation. The area marked on the map is the area proposed by the applicant for residential development.	  	Landscape proposal  Proposed Residential Layout 	The site is 13.68 ha in area. The application proposes development of 348 residential dwellings. Within the design proposal there is a quite significant amount of structural open space in the northern part of the site and middle of the site. The overall density of the site is 26dph but after taking away the area of structural open space the net density for this development is **31 DPH.**	The scheme proposes mainly 2 – 3 storey houses. Density of the site varies depending on character zones. Proposed 'Main Streets' will be lower in density in the range of 30dph. 'The lanes' will be medium density (35dph) and 'Mews Links' will be higher density ranging from 40 - 45dph.

5. Former Oaklands College City Campus housing redevelopment, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
This is a former Oaklands College City Campus site. Permission for demolition of educational buildings, change of use from educational use to residential use of eight buildings, retention of two building as hall and gym and erection of 15 apartment blocks providing a total of 329 units was granted on an appeal in August 2006. The density calculation is for part of the development - the section now redeveloped.	 	Newsom Place   Lemsford Road 	The site in total is 3.3 ha in area. Within the site boundary there are 20 apartment blocks (equivalent of 281 dwellings), gym and hall. After taking away the area of the hall/gym buildings the net density for this development is **93 DPH.**	The scheme proposes mainly 3 – 4 storey apartment blocks. Parking is at reduced level due to proximity to City services and public transport. Some of the parking is underground. This high density development is appropriate to an urban site, but there is space for extensive landscaping.

6. Part of Marshalswick Estate, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Land along Sandpit Lane immediately to the north of current Oaklands application. Marshalswick, St Albans.	 	 Barnfield Road  Southfield Way  Ardens Way	The site is 8.4 ha in area and there are 170 dwellings within the site boundary. Net density for this area is **20 DPH.**	The area consists of 2 – 2.5 storey detached houses with garages/ off street parking and relatively large back gardens.

7. Part of Chiswell Green	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Land enclosed by North Orbital Road to the East and Watford Road to the West, Chiswell Green	 	 Manor Drive  Watford Drive  Forefield	The site is 9.7 ha in area and there are 145 dwellings within the site boundary. Net density for this area is **15 DPH.**	The site consists of a mixture of house types from 1 storey bungalows to 2.5 storey detached houses.

8. Luton Road, Harpenden	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Land enclosed by Luton Road to the North and Tuffnells Way to the South, Harpenden	 	 Ridge Avenue  Wells Close  Tuffnells Way	The site is 10.8 ha in area and there are 190 dwellings within the site boundary. Net density for this for this site is **17 DPH.**	There is a mixture of house types. From 1 storey bungalows to 2 – 2.5 storey terraced and detached houses. Plot sizes vary from 1100 m2 to 215 m2. Most gardens are substantial and there is generally ample off street parking.

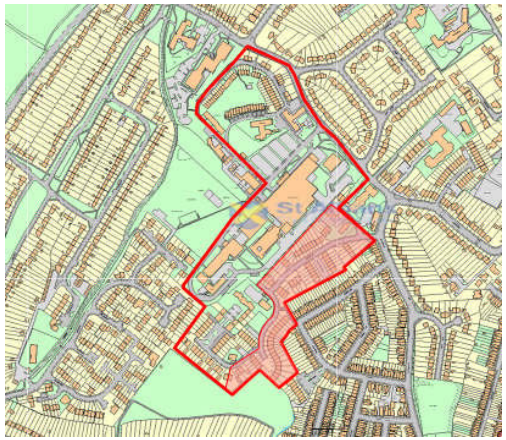
9. Belmont Hill, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
De Tany Court at Belmont Hill, St Albans (former playing fields)	 	 De Tany Ct and related open space (part of former playing field)  De Tany Ct  De Tany Ct	The site is 2.24 ha in total and there are 80 dwellings within the site. Main open spaces are 0.3 ha in total. These are retained parts of the former playing fields and can be regarded as more than amenity open space included in a net area. Density of this site is **35 DPH**. If calculated without play area and open space (south east of the site) the density of this site is **41 DPH**.	This is a residential area with a mix of 2-3 storey houses and maisonettes built in late 80s. The site includes a substantial play area and riverside open space serving the wider area and small pockets of integral open space.

10. Elm Lawns Close, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Elm Lawns Close, off Avenue Road, St Albans	 	 Elm Lawns Close  Avenue Road	The site is 0.4 ha in total and there are 24 dwellings within the site. Net density of this site is **60 DPH.**	This residential development is a mix of 2- 3 Storey houses This is a small site, but it illustrates higher density development with car parking in a cul de sac layout. It comprises housing in terraced form.

11. Land Rear of Sandridge Road, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Archers Fields; R/O 168 Sandridge Road, St Albans	 	 Sandridge Road  Archers Fields  Archers Fields	The site is an urban infill of 0.75 ha in total. There are 27 dwellings within the site. Net density of this site is **36 DPH.**	The site consists solely of 2 storey houses, with gardens. They are mainly terraced, but including some linked detached and detached. There is no integral / amenity open space. There is a substantial unused road frontage (south side of access road) which results in a lower density figure than the layout would achieve if the site were not urban infill, fitting into an existing urban layout.

12. Waverley Road, St Albans	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Pegasus Place off Waverley Road, St Albans	 	 Pegasus Place  Waverley Road	The site is an urban infill development of 0.74 ha in total. There are 36 dwellings within the site. Net density of this site is **49 DPH.**	The site consists entirely of 2-3 storey terraced houses with associated parking and landscaping. The houses have small gardens. There is no integral amenity open space.

13. St Albans Hospital Sites	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Land adjacent St Albans Hospital, Waverley Road, St Albans.	 	 Goldsmith Way  Newmarket Ct  Waverley Road with entrance to St Albans City Hospital	The overall site is 9.2 ha in total. The main hospital site (shaded in red) is 3.2 ha. There are approximately 290 dwellings within the remaining site (6 Ha). Net density for the overall site is **48 DPH.**	The area includes a wide range of dwelling types including some substantial blocks of small flats. The overall site calculation includes some significant areas of open space, the site of a hospice and other hospital related uses. Densities within the overall site vary greatly. Some sub areas where dwellings are predominantly 2 -3 storey houses are considered separately below.

1. Goldsmith Way	 	Goldsmith Way   	The site shaded in red is 2 ha in total and there are 71 dwellings within selected site. Net density for this site is **35 DPH**	Dwellings are 2-3 storey houses. Within the site there are pockets of open space and significant amount of on-street and off-street parking.

2. Newmarket Court	 	Newmarket Court   	The site shaded in red is 1.1 ha in total and there are 43 dwellings within selected site. Net density for this site is **39 DPH**	The site is a mixture of houses and flats with significant amount of on and off street parking space.

14. Station Road, Harpenden (a)	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Mallard Mews / Station Road / Waveney Road, Harpenden	 	 Mallard Mews  Waveney Road  Station Road	The site is 0.25 ha in total and there are 15 dwellings within the site. Density of this site is **60 DPH.**	This is an infill development with a mix of 2.5 – 3 storey flats and houses and apartments. This is a part cul de sac part street frontage development.

15. Station Road, Harpenden (b)	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Station Road, Harpenden (flats)	 	 Station Road  Station Road  Station Road	The application site is 0.41 ha in total and there are 48 dwellings within the site. Net density of this site is **117 DPH.**	This development consists of 2-3 three storey blocks of flats with associated parking spaces to rear of blocks.

16. Redbourn Lane, Harpenden	Map and Aerial Photographs	Photographs	Density Calculations	Notes
Former Central Science Laboratories, Redbourn Lane, Hatching Green, Harpenden	 	 Manor Close  Manor Close  Hatching Green (road leading to the site)	The overall site is 1.9 ha and there are 39 dwellings within the site. Density of this site is **20 DPH.** If calculated without the surrounding open space (approx. 0.63 Ha) then the net density of this development is **32 DPH**	This residential development includes consists 2 storey housing with a mix of terraced, linked detached and detached forms. There is a mix of on-street and off-street parking. There is a substantial setting of open space related to the overall character of the area. This more than integral amenity open space.

17. Luton Road, Harpenden	Map and Aerial Photographs	Photographs	Density Calculations	Notes
40 Luton Road, Harpenden	 	 View from Townsend Road  View from Luton Road  Luton Road	The site is 0.14 ha in total and there are 9 dwellings within the site. Density of this site is **64 DPH.**	This residential development consists of 9 apartments in a 3 storey building with accommodation in the roof space and under croft parking. This is a small infill / redevelopment scheme, but it illustrates how higher density components within an overall area / scheme can contribute to character.

8. Assessment of Infrastructure Capacity

Table 2: Infrastructure to be assessed in the IDP

Infrastructure Category	Sector	Infrastructure Type
Social & Community Infrastructure	Health Infrastructure	• GPs • Hospitals & Acute Provision
	Health and Community Services	• Adult Care Services • Mental Health Care
	Education Infrastructure	• Primary Education • Secondary Education • Further Education • Early Education & Child Care Provision
	Emergency Services	• Police Services • Fire & Rescue Services
	Leisure and Cultural Facilities	• Sports & Leisure Facilities • Cultural Services & Public Realm • Libraries • Cemeteries
Green Infrastructure	Strategic Green Infrastructure	• Forests • Country Parks • Ecological Networks • Rights of Way • River Corridors • Flood risk
	Local Green Infrastructure	• Allotments • Amenity Green Space • Natural & Semi-Natural Green Space • Parks & Gardens • Playing Pitches • Children's Play Areas • Teenage Provision
Physical Infrastructure	Strategic & Local Transport	• Road Network • Public Transport • Walking & Cycling Infrastructure • Parking
Utilities	Water Infrastructure	• Water Supply • Water Drainage & Sewerage
	Energy Distribution	• Electricity Distribution • Electric Vehicle Charging • Gas Transmission & Distribution • Onsite Energy Provision
	Digital Infrastructure	• Internet Access
	Waste Infrastructure	• Waste & Recycling

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Abbey Line Passing Loop Feasibility

Draft Final Report by The Railway Consultancy and others

April 2019

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Forewords

Introduction from Abfly

ABFLY is pleased to introduce this study, which is the culmination of several year's campaigning for improvements and a more frequent service on the Abbey line. This study, the first part of which was financed by our group with a crowd funding campaign, provides a workable and cost-effective solution which would enable an enhanced half-hourly frequency train service to be operated on the line.

The Abbey line fulfils an important link between St Albans and Watford and is currently an underused asset; the chronic road traffic congestion in the area for much of the day demands that solutions be found sooner rather than later, and this study is key to meeting that.

The study provides details of the costs, operational and revenue implications of the increased train service, highlighting the potential of how it might be funded by third-parties such as developers, and also suggests some economical ways of operating the service on the line without affecting the passenger experience to help sustainability. The relatively-simple infrastructure intervention recommended for the line would transform the current service provision, and make the service much more attractive to both current and potential users at a fraction of the cost of road based improvements, plus would also be environmentally better.

We are grateful to the Abbey Line CRP and ACoRP for their financial assistance on the second part of this study and to The Railway Consultancy for working so constructively and generously with us on this important and valuable report.

Foreword from the Chairman of the Abbey Line Community Rail Partnership, County Councillor Derek Ashley:

I welcome this report as a major contribution to the case for developing the Abbey Rail Line to serve the growing population that live and work along the congested St Albans - Watford corridor.

It complements the work done by Hertfordshire County Council. Major housing developments are planned for this part of the county and the impacts are likely to be significant, with traffic congestion predicted to increase further. The recently-adopted Local Transport Plan sets out the County Council's long-term transport strategy and provides a framework to guide all our future transport planning and investment. The improvement of services on the Abbey Line provides one of the important stepping stones to address the transport needs of current and future generations and this study fits perfectly with the listed aspirations of the County Council and of the Abbey Line Community Rail Partnership.

The Community Rail Partnership were pleased to support this study. It will, no doubt, provide a firm foundation for future discussions with our partnership members – the Train Operating Company, local Councils and their elected representatives, Network Rail and the Department for Transport.

Derrick Ashley
Chairman of the Abbey Line Community Rail Partnership
Hertfordshire County Councillor
Executive Member, Growth, Infrastructure, Planning and the Economy

Foreword from the Association of Community Rail Partnerships (ACoRP):

ACoRP are pleased to have been able to support this study through funding from the DfT's Designated Community Rail Development Fund. Community rail is all about ensuring communities get the most from their railways and this work aligns with ACoRP's aims of seeing a rail network which promotes sustainable and healthy rail travel, develops social and economic links and engages the local communities' voice in railway development to meets their needs and deliver social benefit.

Paul Webster
Operations Manager ACoRP

Foreword from the Elected Mayor of Watford:

Watford Borough Council, as an active member of the Abbey Line Community Rail Partnership, welcomes this report setting out the case for investing in improving train services along this line. The Abbey Line is such an important route for many people who travel to and from Watford. Since I was elected, I have been working to try to improve our public transport to ease congestion on our roads. A more frequent, reliable train service will be essential to the successful implementation of those plans.

Peter Taylor
Elected Mayor, Watford Borough Council

Foreword from the Leader of St Albans City Council:

I am delighted to be able to support this study which has now been published. As we progress the St Albans Local Plan there is a strong need for additional transport capacity and infrastructure other than roads to support economic development. We now have something in place to discuss and progress for current and future generations

Alec Campbell
Leader, St Albans City Council

Executive Summary

After infrastructure simplification by British Rail, the 'Abbey line' between Watford Jc and St Albans Abbey has been limited for many years to a 45-minute frequency service, but this is sub-optimal for a railway operating in a largely-urban environment, and various suggestions have been made to overcome this. This report details work carried out to assess the technical and economic feasibility of installing a low-cost passing loop along the line, to enable the service to be improved to half-hourly. The project has been a collaborative effort, and the Railway Consultancy wishes to thank Abfly, ACoRP and local authorities for their support.

The context for renewed interest in improving the line is that, in addition to background rail demand growth, specific and substantial local developments are expected near the line, both near Watford Junction station and on the Radlett aerodrome site. Rail improvements also fit in to wider planning and transport policy objectives.

Our analysis identified Bricket Wood as the best location for a passing loop. In order to minimise costs, lengthening the existing platform there, to achieve a solution pioneered at Penryn in Cornwall, appears promising. We have developed a technical solution ("option E") which minimises signalling costs, subject to some operational constraints, and an increase in journey times of 3 minutes for passing trains. There is an 80% probability of the capital costs of this option being <£8.6m.

The major scheme benefit is in the reduction in passenger waiting times. Construction of a demand model covering the local area and 10 representative traffic sources/destinations elsewhere enabled us to estimate the value of this benefit, once the model had been calibrated on existing conditions, and demand growth from both background trends and the local developments added.

The increases in demand, revenue and time savings resulting from the passing loop were compared against the costs of achieving this. As well as the capital costs, significant operating costs are also incurred, notably in extra traincrew and trainsets. Scheme appraisal showed that the value of the scheme benefits was sufficient to compensate for the capital expenditure, but not the operating costs. A two-pronged strategy is recommended to address this issue, by seeking ways of reducing the operating costs, and other sources of funding income. Particularly promising for the latter are potential development gain monies from a large local housing development at Radlett Aerodrome.

However, the status of this passing loop project needs to compared to other local transport ideas, also designed to address the worsening transport problems of the area. Our quantification of costs and benefits associated with a proposed passing loop at Bricket Wood should enable this possibility to be considered appropriately against other, larger and thus-far less-enumerated suggestions, be those for road improvements of the development of a guided bus system. The feasibility study reported here also provides the evidence base on which to implement the passing loop improvement in a rather shorter timescale than many of the other options, so we recommend it for due consideration.

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Glossary of terms

Acronym or Term	Meaning
ABFLY	Abbey Flyer Users Group
APA (or AsPro)	Asset Protection Agreement
Cadenza	Cadenza Transport Consulting limited
CBI	Computer Based Interlocking
CBTC	Cab Based Train Control
CRP	Community Rail Partnership
DfT	Department for Transport
ECS	Empty Coaching Stock
ETCS	European Train Control System
NR	Network Rail
OLE	Overhead Line Electrification
PRM	Persons of Restricted Mobility
SSI	Solid State Interlocking
TOC	Train Operating Company
TRC	The Railway Consultancy

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1 Introduction

1.1 Background

The Watford – St Albans Abbey line survived the Beeching cuts of the 1960s and has operated at minimal cost ever since. Infrastructure rationalisation effectively reduced the line to a 6 ½-mile-long siding; there are no points or signals except at Watford Junction, and the only operational equipment is related to the level crossing at Watford North. The time taken for a journey along the line (c. 16 minutes) unfortunately means that it is not possible to provide a half-hourly servce, which might be seen to be the minimum appropriate in a largely-urbanised area. Instead, the frequency generally offered is every 45 minutes, this fitting in with a round-trip time which includes a few minutes' recovery time. Nevertheless, this does not mesh well with any of the services with which one might connect at Watford Junction, either for trips to/from London or points North.

About a decade ago, considerable thought was given to converting the line into tram operation, a suggestion which would also have had the benefits of enabling extensions from both ends of the route into the town/city centres of Watford and St Albans respectively. However, the costs which would be incurred in the conversion, plus the costs of a stand-alone operation, were deemed too great for this suggestion to be taken forward (although the actual values of those costs have been difficult to obtain by the public).

The line has enjoyed considerable local support over the years; an Abbey Station Action Group was founded in 1989, and morphed into 'Abfly' in 1995. The Abbey Line Community Rail Partnership was one of the original CRPs designated by the Department for Transport in 1995. Hertfordshire County Council has also been supportive, not least in financial contributions to the CRP, and encouragement to the train operators.

Since rail privatisation in 1995, the Abbey line has been part of franchises concentrating on outer-suburban traffic on the West Coast Main Line. This is a mixed blessing, since these have typically been focussed on that other traffic (e.g. Northampton/Milton Keynes – London, which is far more important commercially), and have been managed distantly (e.g. from Birmingham). Nevertheless, a range of improvements have come about, including the provision of ticket machines at all stations, and a ramp at St Albans Abbey making the station less inaccessible for the mobility-impaired. However, these improvements (whilst welcome) do not address the key issue of poor train service frequency.

The Railway Consultancy has been significantly involved with the line since 2006, not least in organising a 7-year programme of passenger counts and surveys. During that period, broadly in keeping with rail traffic nationally, demand increased by c. 25% (even though there was little, if any, improvement in the service on the line). RCL was therefore pleased to be invited to undertake a feasibility study into the potential for infrastructure works to enable a more frequent service to be operated.

This high-level study for Abfly has been financially-supported by the Abbey Line CRP and ACoRP (through a DfT grant).

1.2 The Location

In order to provide a more frequent service (ideally, regular at half-hourly intervals), it is logical to look for a location about half-way along the line section being investigated.

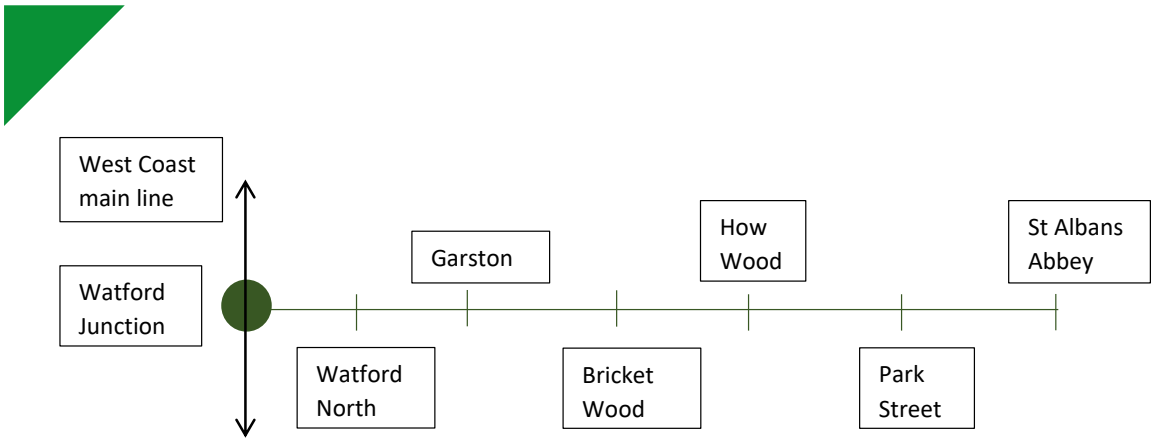


FIGURE 1: ABBEY LINE STATIONS

At present, trains spend slightly longer at the Watford Junction end (typically 8 minutes) than the St Albans Abbey end (typically 5 minutes), which makes some sense because other operational activities may be required (for instance, it is where traincrew are swopped over, when appropriate). This might make a slight difference to the optimum location where trains pass. However, if train services are to run half-hourly, locations for trains to pass are likely to be in the Garston – Bricket Wood area. Nevertheless, it should be acknowledged that one of the problems with designing infrastructure around a particular train service is that it may be unhelpful for other service patterns.

FIGURE 2: GARSTON STATION, LOOKING NORTH TOWARDS BRICKET WOOD

2 The Strategic Case for Intervention

This section describes the context of the line and its rail passengers, and the fundamental reasons why improving train service frequency addresses key issues and therefore could be worthwhile.

2.1 Inadequate Train Service Frequency and Variable Timings

The main objective of the investment options considered here is to increase passenger demand and revenue by increasing train service frequency from its currently-unattractive 45-minute intervals. We should point out that the impacts of lower service frequencies are greater for short-distance journeys, of which waiting for trains forms a greater proportion. The economic theory of generalised cost, on which transport planning is based, reflects changes in their proportionate (not absolute) context. Competition against car (where waiting times are effectively zero) is certainly important in this corridor, even though the parallel road (the A412/A405/B4630) suffers from traffic congestion).

2.2 Support for Transport Policy Objectives

The Abbey line is recognised by local authorities as an important element of the transport network in South West Hertfordshire (SWH), as it provides both a useful transport link and also supports a range of development opportunities. As a consequence, improvements to it are a key part of the Transport Planning package for the whole SWH area (see Figure 2).

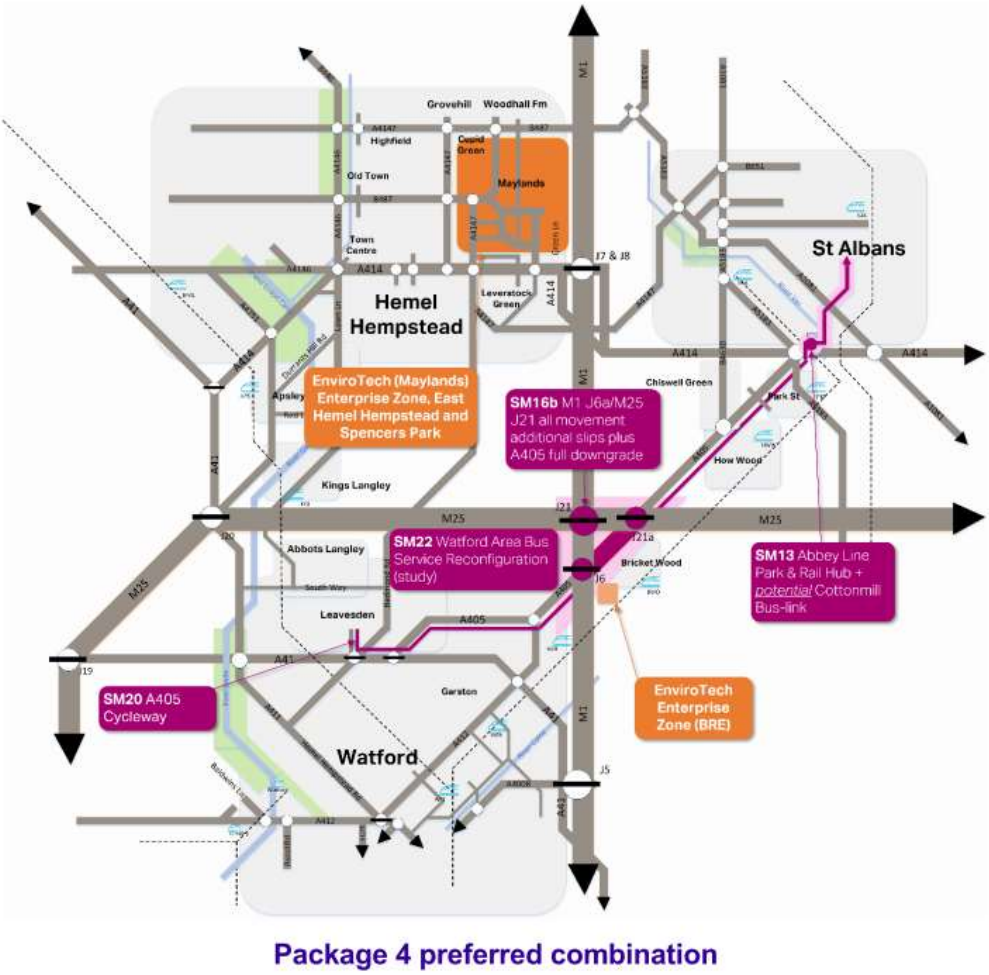


FIGURE 3: SOUTH WEST HERTFORDSHIRE PACKAGE 4: ST ALBANS – WATFORD CORRIDOR

A particular element of interest in package 4, which summarises aspirations for the St Albans – Watford corridor, is the construction of a park & ride facility in the Cottonmill/Park Street area (policy SM13). This could provide easy access for motorists into St Albans, as it lies very close to the A414 strategic road. Whilst it might be built as a separate station, this would lead to several stations being very close together (How Wood, Park Street and Cottonmill) and so other options necessarily include double-ending Park Street to provide access at the Cottonmill end, or moving Park Street a few hundred metres Northwards, to be more convenient for park & ride purposes.

2.3 Support for Housing and other Economic Growth in the Corridor

The Abbey line is also important in supporting the locations required to deliver the housing and other development growth needed within local plans. A number of sites are worth mentioning, as likely to contribute significantly to potential demand for rail services on the line.

First, a very large number (2300) of new dwellings are expected to be located on the old Radlett Aerodrome site, and named Park Street Garden Village. Based East of Frogmore, many of these will be conveniently-located for How Wood station, from which a footpath/cycleway is expected to lead directly into the centre of the development.

Secondly, Watford Borough Council has put together a Master Plan for redeveloping the area around Watford Junction station as a high-density hub, supported by the rail services in various directions. Buildings of up to 14 storeys are envisaged, decreasing in height as one moves away from the station. Some developments are rebuilds of existing buildings, whilst others are new; several already have planning permission or are even under construction. Development includes land on both sides of the Abbey line (i.e. both on the current concrete works site, to the South, as well as towards St Albans Road, to the North). As well as residential units, new office space of well over 10,000m^2 is also expected. In total, this will completely transform the nature of Watford Junction station, and how it is used, as can be seen from the 3d model view of the Masterplan, shown as Figures 4 & 5.

FIGURE 4: WATFORD JUNCTION AREA: 3D MODEL VIEW FROM SOUTH-EAST

FIGURE 5: WATFORD JUNCTION AREA: TYPE OF DEVELOPMENT PROPOSED

Developments at a number of other sites relevant to the line included within the summary in the Table below. The importance of these is that the vast majority of these developments are within easy walking distances of stations, giving rail a potential edge over other modes of transport.

Location	*Dwellings*	*Econ. Active Population*
Radlett Aerodrome (Park Street/How Wood)	2,300	3,450
Hanstead House (former HSBC Training Centre) (Bricket Wood)	138	207
Farriers Wood, Bucknalls Lane (2018) (Garston/Bricket Wood)	55	83
Total residential units (St Albans City Council area)	**2,493**	**3740**
Clarendon House 33 Bridle Path	41	41
149 St Albans Road	146	146
Caledonian House, 39 St Albans Road	93	93
16-18 St Albans Road	90	90
37-39 Clarendon Road	154	154
94-98 St Albans Road	1,100	1,100
Watford Junction Network Rail/Concrete works sites	2,500	2,500
Total residential units (Watford Junction plan area)	**4,124**	

TABLE 1: NEW HOUSING BEING DEVELOPED AROUND THE ABBEY LINE

Source: first two columns: Abfly; column 3 RCL estimates, assuming that half the population are economically-active, and that Watford-area developments are in flats containing 2 people, and the rest in houses containing 3 people

2.4 Ability to use innovation and other contractors for project delivery

Network Rail has historically been relatively expensive in its project delivery, but there has been recent eagerness by Government and others to enable some rail infrastructure works to be undertaken by third parties, the creation of a separate East-West Rail Company to deliver the Oxford – Cambridge scheme being a particular case in point. Previous examples of privately-funded infrastructure (e.g. Warwick Parkway station and Evergreen 1 projects) have been seen to be reasonably successful – and to have provided comparable, if not cheaper, costs. There may also be potential for innovation on this line (which is largely separate from the main national rail network), which might not be realised if Network Rail adopted its normal policies and standards.

2.5 Summary

The catchment area of the Watford – St Albans area which the Abbey line serves is over 200,000 people. Committed and planned developments are expected to increase the numbers of both residential population and employees in the coming years, for which the current train service is ill-equipped to serve.

Barriers to increasing rail use include:

1. Difficulties in accessing stations;
2. Poor facilities at stations;
3. Shortcomings of the train service; and
4. Problems in getting from the terminating station to the final destination.

The purpose of this study is to develop solutions to address the third of these barriers, recognising that attention to the other three has been at the heart of work by Abfly and the Community Rail Partnership over the last decade or so.

The case for intervention has got stronger over the years, as the base level of demand has increased. The expected (revenue, time saving and wider economic) benefits are therefore higher than they would have been, at previous times when investment in this line was considered. Rail demand is expected to continue to grow in general, but there are various reasons why stronger growth is expected in this corridor.

3 Preliminary optioneering

3.1 Design objectives

The high-level design objectives we have sought to achieve in the development of a solution are as follows:

- Provide infrastructure that will enable service frequency to be doubled whilst ensuring operational robustness and efficiency
- Maximise the cost-efficiency of any new solution
- Ensure that new facilities are compliant with current accessibility guidance from the Department for Transport (DfT)
- Avoid any land take that might trigger expensive and lengthy planning procedures such as a Development Consent Order or Transport and Works Act Order

3.2 Option A: Dynamic passing loop between Garston and Bricket Wood

A dynamic passing loop is a long length of parallel track enabling both trains to pass at speed – ideally without slowing down. This is (in theory) a very efficient way of increasing the frequency of the service but it is dependent on accurate timekeeping for both trains as a delay for one train can immediately impact on the other.

The length of a dynamic loop is dependent on how much timetable resilience is needed – which may not be much on a closed-system like this, but if trains are significantly delayed, there can be substantial delays to passengers on a train sitting in a loop waiting for the other train to pass. Factors that dictate the length of the loop include the line speed, the signalling system and overlap lengths, and level of timetabling tolerance required.

A train travelling at 50mph (the local line speed) covers about 22m per second. The closing speed of two trains in opposite directions is therefore about 44m per second. In order to provide a 30-second tolerance, this implies a loop length of 1.3km – in addition to that required for trains to enter the loop and for signalling to have proved them clear of the previous signalling section with enough time to avoid each train slowing down.

In effect, most of the section between Garston and Bricket Wood would need to be double-tracked and the presence of overbridges such as the M1 could limit the available length to about 1.5km. All the Overhead Line Electrification (OLE) would need to be reconstructed because the existing cantilever supports are where the second track bed would need to be.

On this high-level basis, we concluded that this option was probably theoretically possible but likely to be disproportionally expensive and likely to introduce an operational constraint that would be very intolerant of variances in the train timings.

3.3 Option B: Passing loop at Garston

A static passing loop at Garston was considered in the desktop study because it is closer to the timetabled half way point and would therefore reduce impact on operational flexibility.

From the desktop study we determined that:

- It was likely to be difficult to construct a second track and platform within the Network Rail (NR) boundary)

- A passing loop would be slightly hemmed in by the single-track underbridge over the Gossamers
- A potential underpass access to Fourth Avenue would unlock access for a lot of pedestrians from the West who otherwise have a much longer walk. This could be worth doing even if the passing loop is not located here
- The same underpass would avoid the cost of a bridge and could probably be fairly easily be constructed in a long weekend
- There would be no real vehicular access possible (as now), and while this can be a positive thing, it does disadvantage PRMs

Although the underpass idea was attractive in principle, as was the potential to unlock more of the housing to the West of the railway, the probable difficulty of constructing a second platform and passing loop in this location meant that it was unlikely to be fruitful to continue pursuing this option.

Although we were not able to visit Garston station for a site visit as part of this current work, we have been there before, and were again able to view the location from the train window. These initial views suggest that space is very limited for a platform, and that the ground levels relative to the track were not as low as expected, effectively ruling out an underpass.

3.4 Option C: Static passing loop immediately south of Bricket Wood station

A static passing loop immediately to the south of Bricket Wood station would avoid the cost of a second platform and associated bridge works, making it less expensive than an in-station option. Trains to St Albans Abbey would wait in the loop for the London-bound service to depart the Bricket Wood station.

However, it would incur the same track, signalling and electrification costs as an in-station option and would add generalised journey time cost implications for every northbound journey.

From a passenger experience perspective, it would be very frustrating for passengers to be on a train that waited short of Bricket Wood to allow the Watford Junction-bound train to pass before pulling in to stop at the station.

Therefore, although this option would probably be cheaper than others, we considered that the passenger experience would significantly detract from the benefits and decided not to pursue it further.

3.5 Option D: Passing loop with two platforms at Bricket Wood

The option to provide a static passing loop at Bricket Wood is potentially attractive because:

- There appears to be sufficient space for the northbound platform
- It is close to the route midpoint by distance, so would have a reasonably low impact on the timetable
- There is an existing public footbridge to the north of the station which might be repurposed as the station footbridge. It could potentially be connected to the platforms by ramps (which would require a continuation of the current open platform policy, so no problem expected there)

Some initial photographs and videos helpfully provided by Abfly indicated that:

- The existing footbridge is in poor condition and was perhaps originally designed for two tracks, but the current alignment goes through the middle to give headroom for the overhead line electrification

- The public footpath between Station Road and Black Boy Wood road looked too steep approaching the footbridge on each side to meet DfT accessibility requirements

The working proposition therefore was to offset the Northbound platform slightly to the South, so the two tracks can merge into one under the footbridge. If necessary, the footbridge may have to be reconstructed (re-using the existing abutments) to enable PRM access.

3.6 Option E: Static passing loop with one platform at Bricket Wood

Following discussion at the Abbey Flyers Community Rail Partnership meeting on 29 May 2018, we investigated further a hybrid between options C and D which is similar to an arrangement used at Penryn in Cornwall. In order to illustrate how the principle might be applied at Bricket Wood, we have developed the schematic drawing in **Error! Reference source not found.**

In this option, a Southbound train would arrive at the new extended platform first, and would be proved to have stopped before the Northbound train could approach the junction at the southern end of the station. The Northbound train would then pass the Southbound train in the new loop, and draw forward, stopping in the existing part of the platform which is now only for Northbound services. As soon as the Northbound train is in the loop and the single line section to Watford Junction is cleared, the Southbound train may then depart. The Northbound train is able to continue through the loop and stop at the Northern part of the platform and continue North when it wishes to.

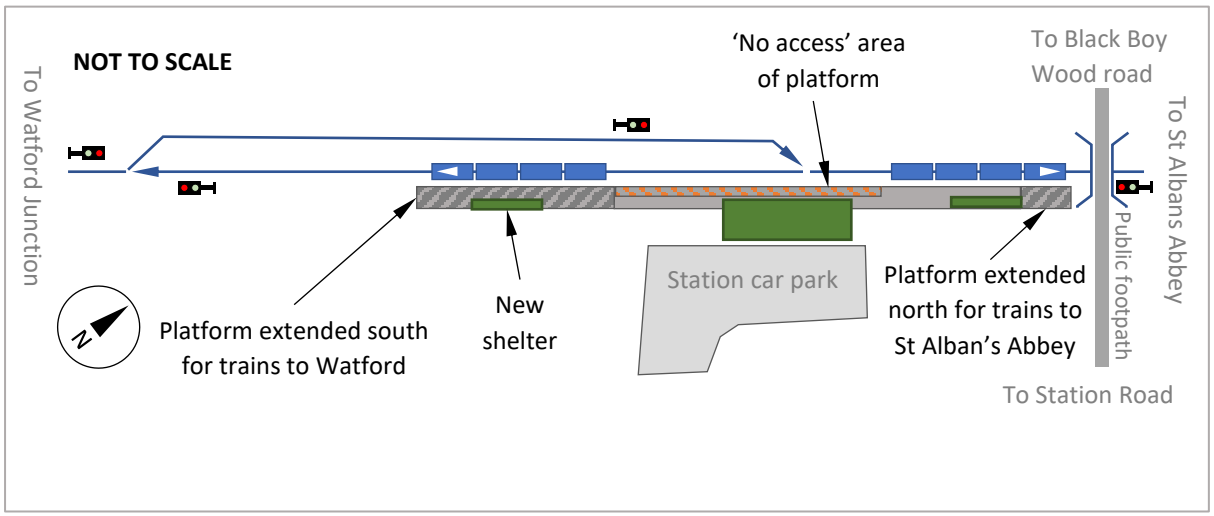


FIGURE 6: PASSING LOOP WITH SINGLE PLATFORM AT BRICKET WOOD

This is a very neat solution that avoids the cost of a footbridge. But it also has a similar operational constraint to Option C in that, if the Southbound train is running late, the Northbound train will have to wait in the loop until the route ahead is clear. However, unlike Option C, the undesirable feature of Northbound services stopping in the loop and then in the station does not take place under normal operations.

3.7 Selection of solutions for development

It is important to understand the manner in which the proposed solution has become the recommended one. In some cases of scheme development, various options may be considered until relatively late in the project, with each having advantages and disadvantages, as shown in the diagram below.

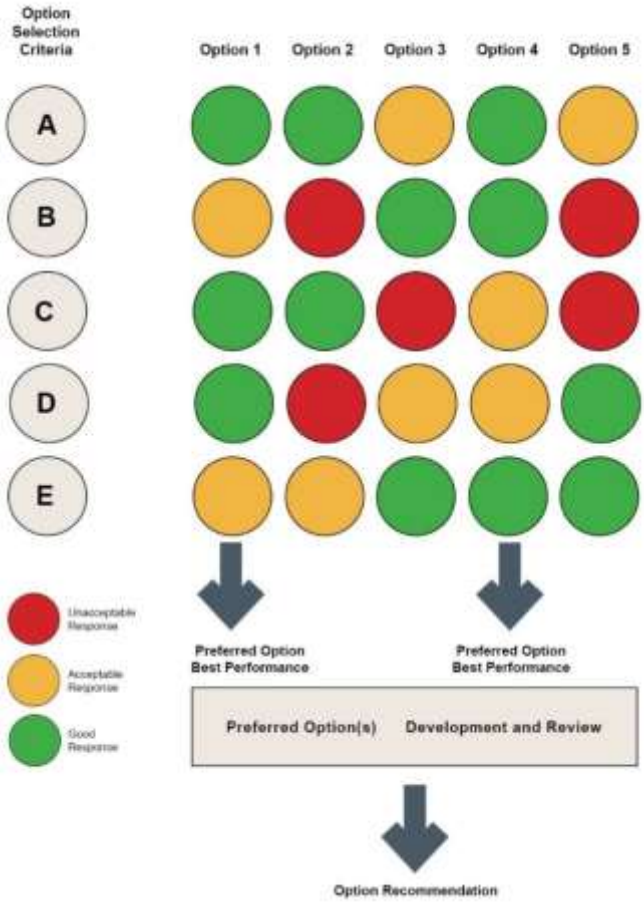


FIGURE 7: OPTION SELECTION PROCESS

However, in this case, three of the options had features which contravened the initial requirements. The dynamic passing loop (Option A) seems viable, but expensive and operationally limiting. The passing loop at Garston (Option B) seems unlikely to be viable, and inaccessible to vehicular access. The static passing loop south of Bricket Wood (Option C) seemed cheap but likely to result in a very unsatisfactory customer experience. Since these options are unlikely to meet the project objectives, they have not been pursued further.

The passing loop with two platforms at Bricket Wood (Option D) achieves the objectives and provides the best operational solution. The hybrid single platform loop (option E) similarly meets the objectives, avoids footbridge costs and can be operationally efficient if trains run to time. The trade-off for these two options is between capital cost and relative benefits.

We have therefore developed both options D and E to a similar level so that this trade-off can be better understood.

4 Option D: Design commentary

4.1 Design proposals

4.1.1 Overview

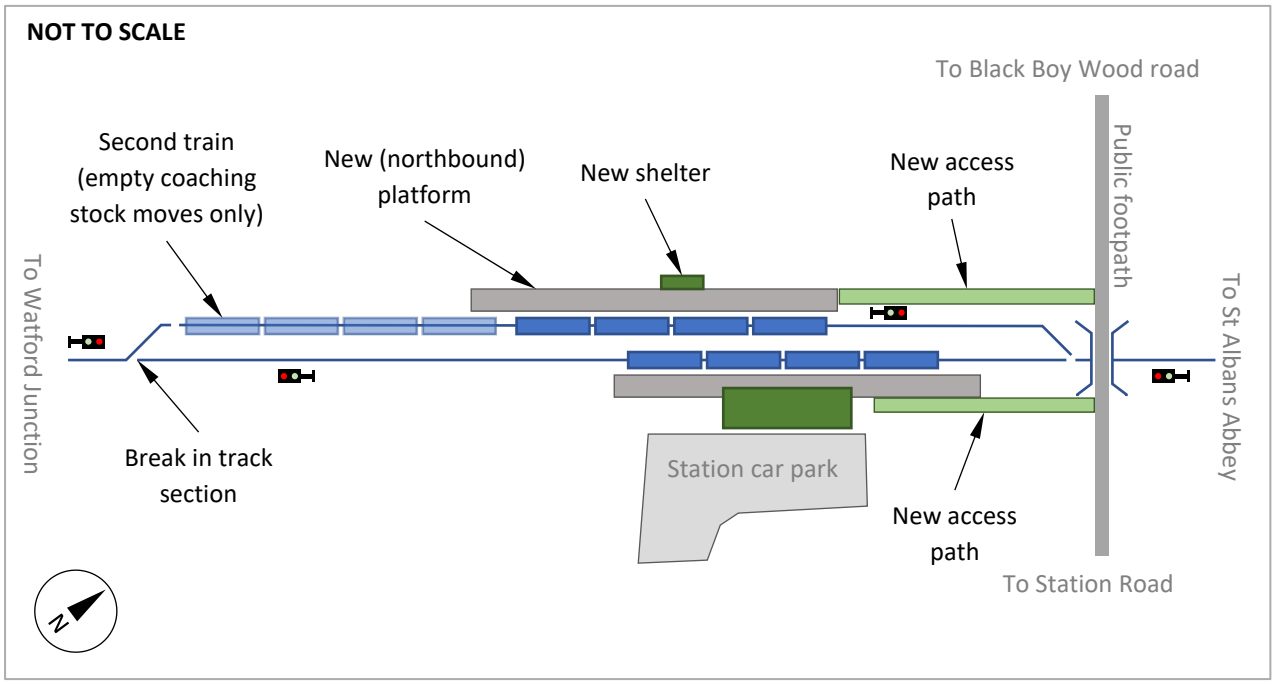


FIGURE 8: SCHEMATIC OF TWO-PLATFORM BRICKET WOOD SOLUTION

This option includes a passing loop on the West side of the track at Bricket Wood station as shown in Figures 8 and 9. In this location, we have included a 2.5m-wide platform suitable for a four-car length train, accessed via ramps that connect to the existing brick overbridge. A small shelter on the new platform will provide protection from the elements for waiting passengers.

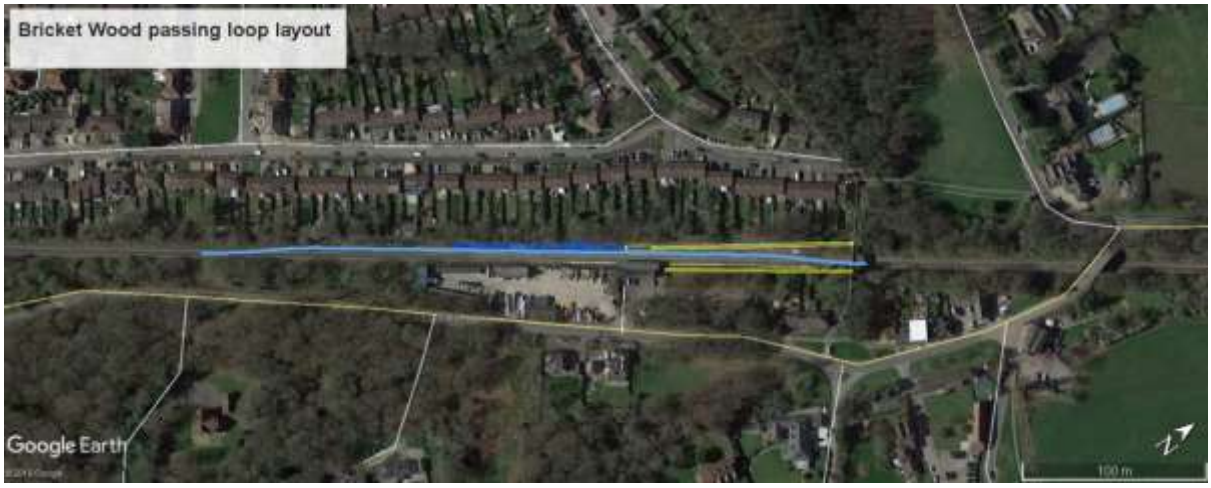


FIGURE 9: AERIAL MAP LAYOUT OF TWO-PLATFORM BRICKET WOOD SOLUTION

4.1.2 The access ramps

The new platform on the west side would be accessed via a ramped path on an embankment or retained earth structure that connects to the existing brick overbridge. We would anticipate that the fill for the embankment would be taken from the existing material that would be otherwise removed

to make way for the platform. We gleaned from a recent Community Rail Partnership meeting that the current mound of vegetation hides the original platform that might be refurbished. This will reduce costs of movement and disposal. There are a range of possible embankment construction options here that are similar in cost, ranging from gabion walls to geogrid retained earth structures.

On the east side, a new metal ramp structure would be provided to give access to the existing platform. The metal ramp structure would be required here because of the lack of space available to construct an embankment.

Given the proximity of the ramps to local housing, we would expect the ramps to include privacy fencing on the side nearest the railway's neighbours.

Both the new ramps (and the connection over the existing bridge) would comply with Department for Transport (DfT) guidance[1] on gradients for Persons of Restricted Mobility (PRMs) so that PRMs can access both platforms satisfactorily.

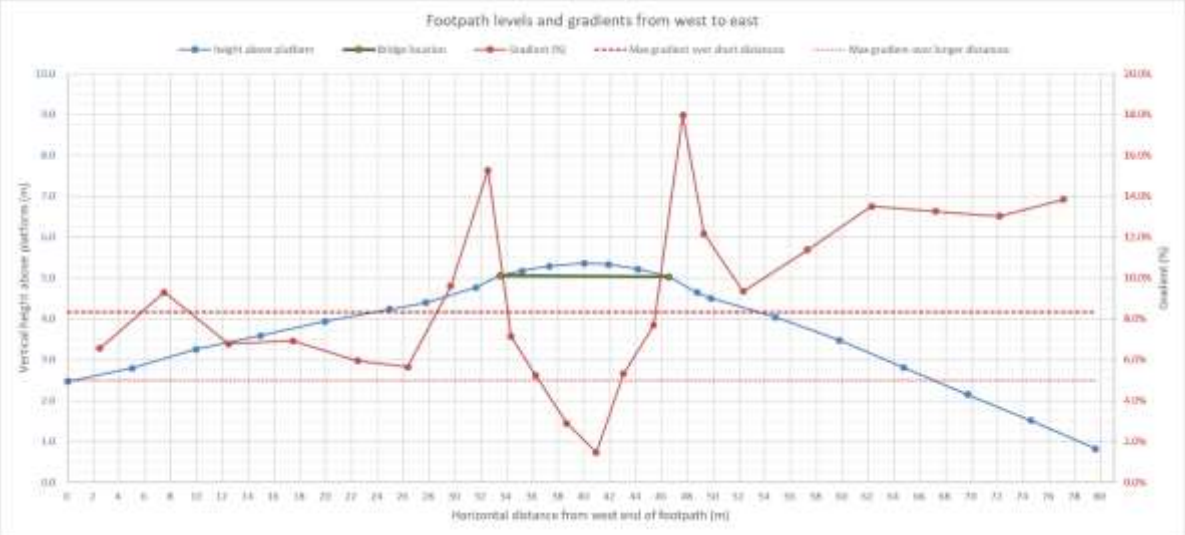


FIGURE 10: PUBLIC FOOTPATH LEVELS AND GRADIENTS

We had looked at the possibility that the connecting public footpath from Station Road to Black Boy Wood might be amended as part of this work (though perhaps separately funded) to meet accessibility standards and hence provide better access to the railway. Our site visit showed us that the existing gradients are so steep (see **Error! Reference source not found.**) that this would be a considerable undertaking involving new structures and a level of expenditure that would be difficult to justify.

Our proposal is therefore to connect the path/ramp to the public footpath either side of the existing footbridge, and blend the vertical alignment of the path to a gradient consistent with the existing gradients on each respective side so that, ideally, it is no worse than existing.

4.1.3 The platform

The location of the new platform is driven by two important constraints. The first is the existing footbridge at the north end of the station; the second is the introduction of signalling. These are described below.

[1] https://www.gov.uk/government/publications/accessible-railway-stations-design-standards

FIGURE 11: MASONRY ARCH FOOTBRIDGE TO THE NORTH OF BRICKET WOOD STATION

Although the masonry arch footbridge shown in **Error! Reference source not found.** was probably built for two tracks originally, the existing track is aligned fairly centrally through the arch to enable the Overhead Line Electrification (OLE) to pass beneath the structure. This approach is often taken where headroom is limited, in order to avoid incurring bridge reconstruction costs when electrification is introduced. The existing platform has been positioned to meet the track in this location, and therefore it is impractical to move the track to allow a second track through again.

The introduction of signalling is necessary because two trains are working on the same route and must be protected from each other. This means that there is a minimum distance of 20m from the train stop point on the platform to the signal, and then a 60m overlap which would allow trains that pass the signal in error to be automatically stopped before they reach the Fouling Point where they might conflict with a train coming the other way. The distance between the Fouling point and the switch tips of the turnout is about 45m.

When these two issues are combined, the effect is that the Northern turnout can only be started where the footbridge is, and the length of the various distances results in the platform being located just over 120m from the footbridge. This is slightly further than the 100m needed for the ramp length.

4.1.4 The passing loop

The passing loop is approximately 360m long and is intended to allow for two 4-car train sets to be brought in (as an Empty Coaching Stock (ECS) move) before being split at Bricket Wood at the start of the day. Similarly, the two trains on the route will be joined at Bricket Wood at the end of the day. This unusual arrangement is driven by the desire to minimise signalling costs.

The signalling and operational strategy proposed is complex in order to avoid the costs of extending the existing controlled signalling network up to Bricket Wood. This is because an extension of the existing network would require several miles worth of cabling works, but also the modification of the control room with possible implications on staff workloads; this can, in some instances, trigger additional staffing requirements. Although the precise impacts of extending the existing signalling are not currently known or investigated, it is our experience, and that of our specialist signalling subcontractor, Kilborn Consulting Ltd, that such amendments invariably unlock a cascade of effects that rapidly increase the cost of the project out of all proportion.

We have therefore proposed an approach that retains the existing token-operated track operations, but creates an automatically controlled signalling 'island', thus avoiding extensive cabling or impact on the signaller's workload. However, it does result in new operational procedures and the need to extend the passing loop to accommodate a double-length train to be split or joined in the passing loop. Further explanation of the signalling approach is contained in Appendix 0.

It is our view that cost of the extra length of passing loop is likely to be less than the signalling costs which would form part of a more conventional signalling extension scheme.

4.2 Design assumptions and constraints

The following have been used as key assumptions or constraints in the design development. Substantial changes to these assumptions may result in the amendment of the design solution.

Assumption or constraint	Value	Unit	Basis
Maximum train length	4	Cars	Discussion with The Railway Consultancy ref email 26 Feb 18
Train car length	20	m	Discussion with The Railway Consultancy ref email 26 Feb 18
Max speed over turnouts	25	mph	Based on RT60C data
Total length required for two trains to split and join	170	m	NR/L2/TRK/2049 A.8.14
Signal stand back	20	m	Standard preferred distance
Signalling overlap	60	m	Standard distance for 25mph speed (based on advice from Kilborn Consulting Ltd)

TABLE 2: NUMERICAL DESIGN ASSUMPTIONS AND CONSTRAINTS

There are also the following non-numerical assumptions or constraints that have proved important in the design development:

- **Assumed that the footbridge at Bricket Wood will remain in situ:** Ownership and maintenance plans unknown. However, it was noted on the site visit that fractures indicate historical distress suggesting differential settlement (see **Error! Reference source not found.**).
- **Assumed that clearance under footbridge at Bricket Wood is not sufficient for two trains (and electrification):** Visual inspection suggests that although the bridge may have been originally built for two trains, the current alignment of the single track is centred to enable the Overhead Line Electrification (OLE) to pass under the centre of the arch
- **Assumed that positioning the track centreline separation at 4.0m instead of the more usual 3.405 will enable the existing track drainage to remain in place:** Estimate based on Google Earth imagery

- **Assumed that the Train Operating Company (TOC), drivers' unions, and NR Signalling will accept the proposed approach:** The signalling proposal is based on a first principles solution suggested by Kilborn Consulting Ltd to limit the expense of installing signalling infrastructure
- **Assumed that it is not necessary to amend the public footpath gradient from Station Road to Black Boy Wood to comply with Department for Transport guidance for Persons with Restricted Mobility (PRMs):** This footpath is already well above the limiting gradients for most of its length
- **Assumed that permission will be granted to make local amendments to the public footpath to connect with the platform access ramp/path:** This can be achieved without modification to the bridge itself, and the footpath gradient can be made more consistent

FIGURE 12: EXAMPLE FRACTURE TO PARAPET AT NORTH WEST OF THE BRIDGE (ADJACENT TO PREVIOUS REPAIR)

4.3 Risks and opportunities

Risks

Risk	Rating	Suggested mitigation activities
Network Rail / TOCs / Unions / HMRI do not accept the signalling proposal resulting in a much more expensive proposal	Medium	Engage with key stakeholders early in the next phase to explain what we propose and why
Electrification system not sufficient to handle additional loop and power draw from near simultaneous start of two trains, resulting in additional power requirements	Medium	Seek specialist traction power advice in next stage
Signalling overrun risk assessment results in additional distance needed between the platform and the crossover leading to increased cost and decreased ease of access	Low	Engage with key stakeholders early in the next phase to explain what we propose and why

Risk	Rating	Suggested mitigation activities
Local objection to ramps near houses (because of fear of being overlooked, despite fencing) leads to additional security measures or delay to the project	Low	Develop some privacy fencing options and engage with those who may object early on to identify their preference; remind them that their house values will probably benefit from this project
Track drainage needs to be remodelled as a result of the second track	Low	Seek advice from local Network Rail drainage engineers

TABLE 3: PRIMARY RISKS FOR OPTION D

Opportunities

Opportunity	Rating	Suggested enabling activities
Adopt the site adjacent to the station car park as a construction site for contractors	Medium	Ask Network Rail for guidance on local land ownership.
Reconstruct the footbridge with a flat deck structure, reusing existing abutments, to enable the track doubling to start further north	Low	Check if Network Rail is planning to carry out any major works to this structure in the near future that might be modified to incorporate deck reconstruction
Obtain support for trialling Cab Based Train Control (CBTC) signalling system, which could be much more expensive but separately funded. [This would be an ideal trial location for this next-generation signalling system]	Low	Connect with Digital Railway and potential suppliers of these systems to see if any is willing to adopt this as a test bed to demonstrate their equipment to the UK railway industry

TABLE 4: PRIMARY OPPORTUNITIES FOR OPTION D

4.4 Costs commentary

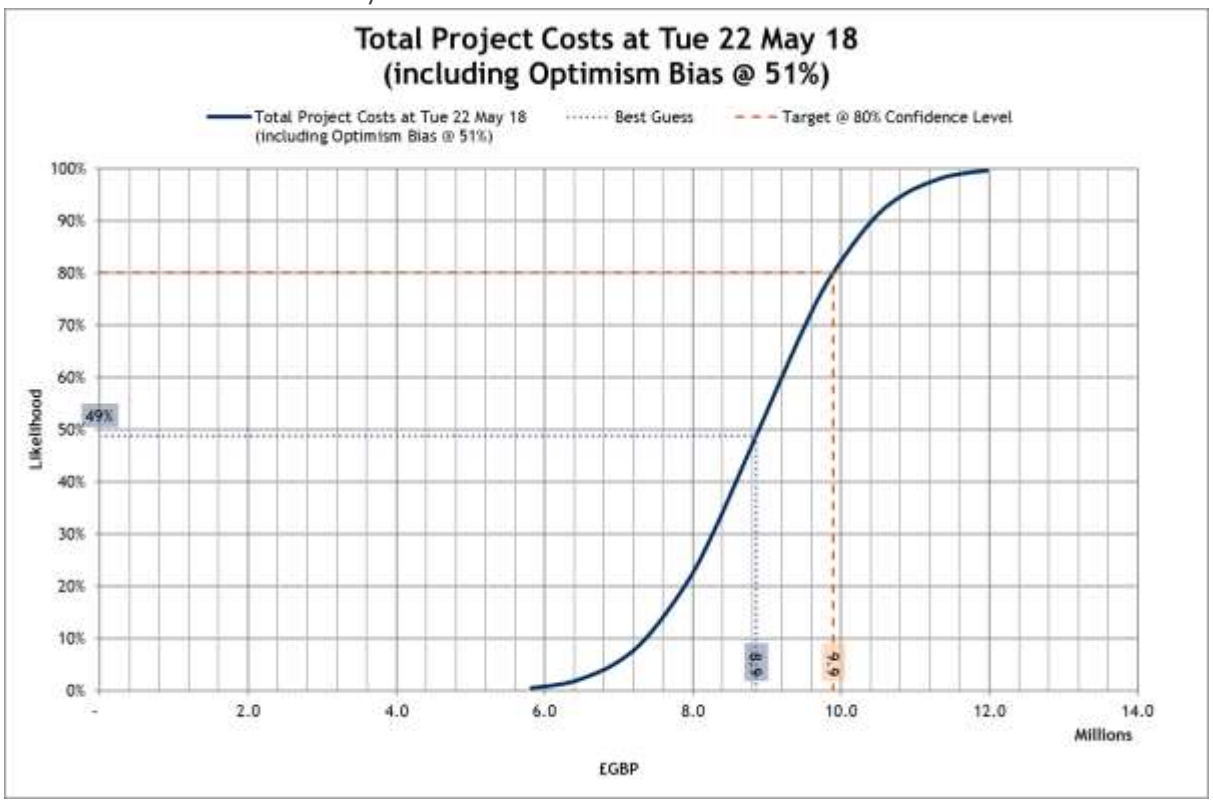


FIGURE 13: 'S-CURVE' OF OPTION D PROJECT COSTS INCLUDING OPTIMISM BIAS AT 51%

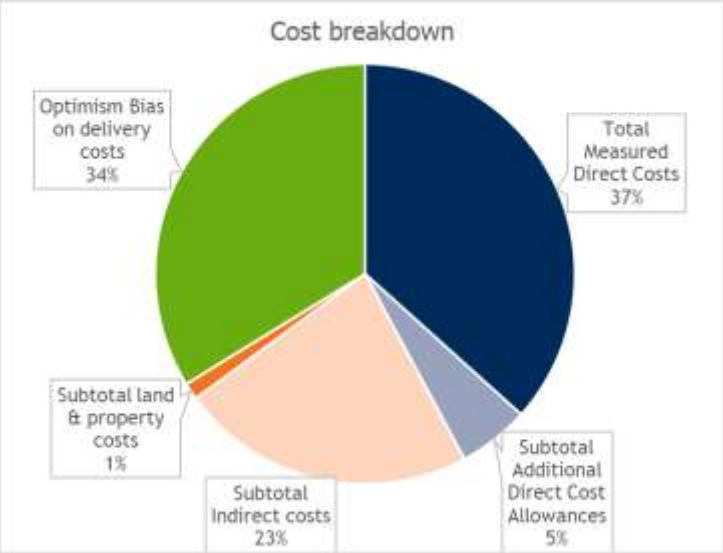
We have prepared a high-level cost estimate commensurate with the concept level of design work undertaken to date. Using 'all-in' rates for measured direct costs, and allowances for various on-cost items such as design, planning, legal and other enabling work, we have developed a cost range as

illustrated in **Error! Reference source not found.**. This includes the industry standard 'Optimism Bias' (see Appendix B1 Optimism Bias) for this stage and type of project of 51%.

The probability range simply illustrates that our 'Best Guess' point estimate is currently £8.9m, and that we consider there is statistically a 49% chance that the project will be delivered for this cost or less. Since this level of confidence is probably too low for most funders, we have illustrated the level of budget required for an 80% confidence level (P80), which can be seen to be £9.9m. We would recommend that this P80 estimate is the one adopted in further correspondence.

The breakdown of the costs is shown in Figure 14: Breakdown of Option D costs

, illustrating that the Measured Direct costs amount to some 37% of the total cost, the rest being made up of allowances for enabling activities, and then Optimism Bias on top. Further explanation of the other cost allowances is shown in Appendix B2 Cost categories



The top five most influential cost items in the Measured Direct costs are, in order:

1. Turnouts
2. Electrification
3. Signalling
4. New track
5. Up side ramp

These represent the items where the quantum and variability of cost have the greatest influence on the final price and therefore give the priority for attention at the next stage of design.

FIGURE 14: BREAKDOWN OF OPTION D COSTS

5 Option E: Design commentary

5.1 Design proposals

5.1.1 Overview

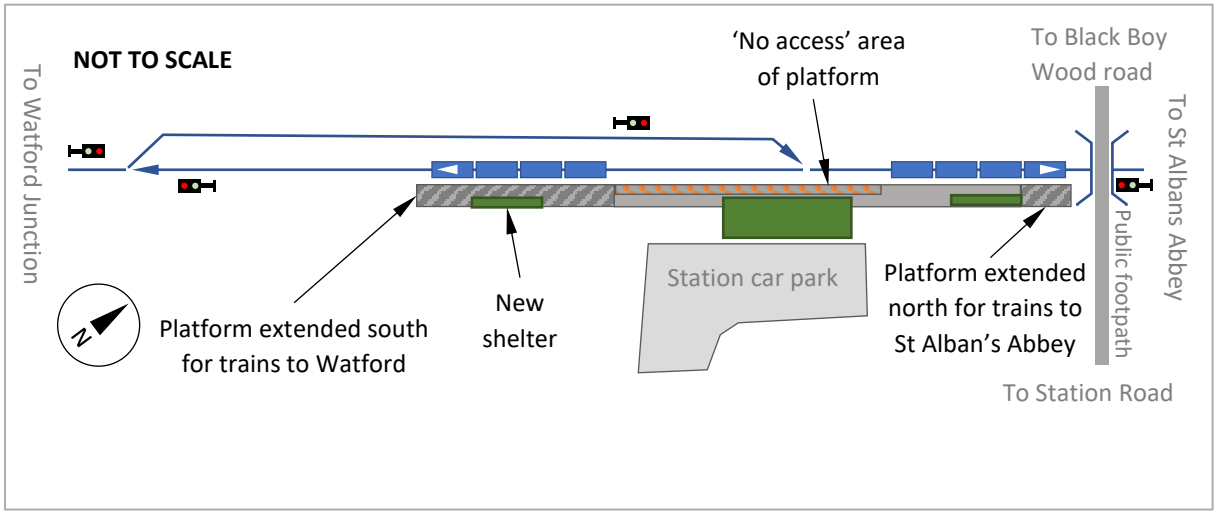


FIGURE 15: PASSING LOOP WITH SINGLE PLATFORM AT BRICKET WOOD

In the selected solution, we have proposed a passing loop on the west side of the track at Bricket Wood station as shown in Figures 15 and 16. The existing platform is extended to the north and the south to serve the northbound and southbound services respectively.

FIGURE 16: AERIAL MAP LAYOUT OF PASSING LOOP WITH SINGLE PLATFORM AT BRICKET WOOD

5.1.2 The platform

The Northbound platform extension can be the same width as the current platform and assumes full use of the existing constructed platform is possible[2].

The Southbound platform is constrained to the available land between the track and the adjacent property. Although we have not been able to measure this directly, it appears to be between 2.5 and 2.9m which is sufficient for a single face platform. However, it does not give much available width for a shelter and we have assumed a shelter that is longer and thinner than normal will be necessary in this location.

Because of track points, the minimum distances for positioning of insulating rail joints and train stopping tolerances, there is a distance of some 75m on the existing platform that would become a

[2] The existing platform has a notice preventing passenger access to the northernmost 20m approximately.

'no access' area for the train. This is unfortunate, because it will be confusing for passengers to arrive at the station and find that the trains do not stop in front of them, and that the existing shelter is no-where near the trains.

We have therefore provided two new small shelters for each service to provide protection from the elements for waiting passengers and encourage movement toward the middle of the trains.

5.1.3 The passing loop

The passing loop length is calculated in the same way as Option D.

5.2 Design assumptions and constraints

The following have been used as key assumptions or constraints in the design development. Substantial changes to these assumptions may result in the amendment of the design solution.

The numerical assumptions used in **Error! Reference source not found.** for Option D have been adopted for Option E also.

FIGURE 17: VIEW SOUTH FROM BRICKET WOOD STATION PLATFORM

There are also the following non-numerical assumptions or constraints that have proved important in the design development:

- **Assumed that there is sufficient space between the track and the adjacent landowner boundary that a platform of at least 2.5m width may be constructed.:** Ownership and maintenance access plans are unknown but Figure suggests there is sufficient width available.
- **Assumed that positioning the track centreline separation at 4.0m instead of the more usual 3.405 will enable the existing track drainage to remain in place:** Estimate based on Google Earth imagery
- **Assumed that the Train Operating Company (TOC), drivers' unions, and NR Signalling will accept the proposed approach:** The signalling proposal is based on a first principles solution suggested by Kilborn Consulting Ltd to limit the expense of installing signalling infrastructure

5.3 Risk and opportunities

Risks

Risk	Rating	Suggested mitigation activities
Network Rail / TOCs / Unions / HMRI do not accept the signalling proposal resulting in a much more expensive proposal	Medium	Engage with key stakeholders early in the next phase to explain what we propose and why
Electrification system not sufficient to handle additional loop and power draw from near simultaneous start of two trains, resulting in additional power requirements	Medium	Seek specialist traction power advice in next stage
Track drainage needs to be remodelled as a result of the second track	Medium	Seek advice from local Network Rail drainage engineers
Signalling overrun risk assessment results in additional distance needed between the two connected platforms leading to increased cost and decreased ease of access	Low	Engage with key stakeholders early in the next phase to explain what we propose and why
Local objection to ramps near houses (because of fear of being overlooked, despite fencing) leads to additional security measures or delay to the project	Low	Develop some privacy fencing options and engage with those who may object early on to identify their preference; remind them that their house values will probably benefit from this project

TABLE 5: PRIMARY RISKS FOR OPTION E

Opportunities

Opportunity	Rating	Suggested enabling activities
Adopt the site adjacent to the station car park as a construction site for contractors	Medium	Ask Network Rail for guidance on local land ownership.
Obtain support for trialling Cab Based Train Control (CBTC) signalling system, which could be much more expensive but separately funded. [This would be an ideal trial location for this next-generation signalling system]	Low	Connect with Digital Railway and potential suppliers of these systems to see if any is willing to adopt this as a test bed to demonstrate their equipment to the UK railway industry

TABLE 6: PRIMARY OPPORTUNITIES FOR OPTION E

5.4 Costs commentary

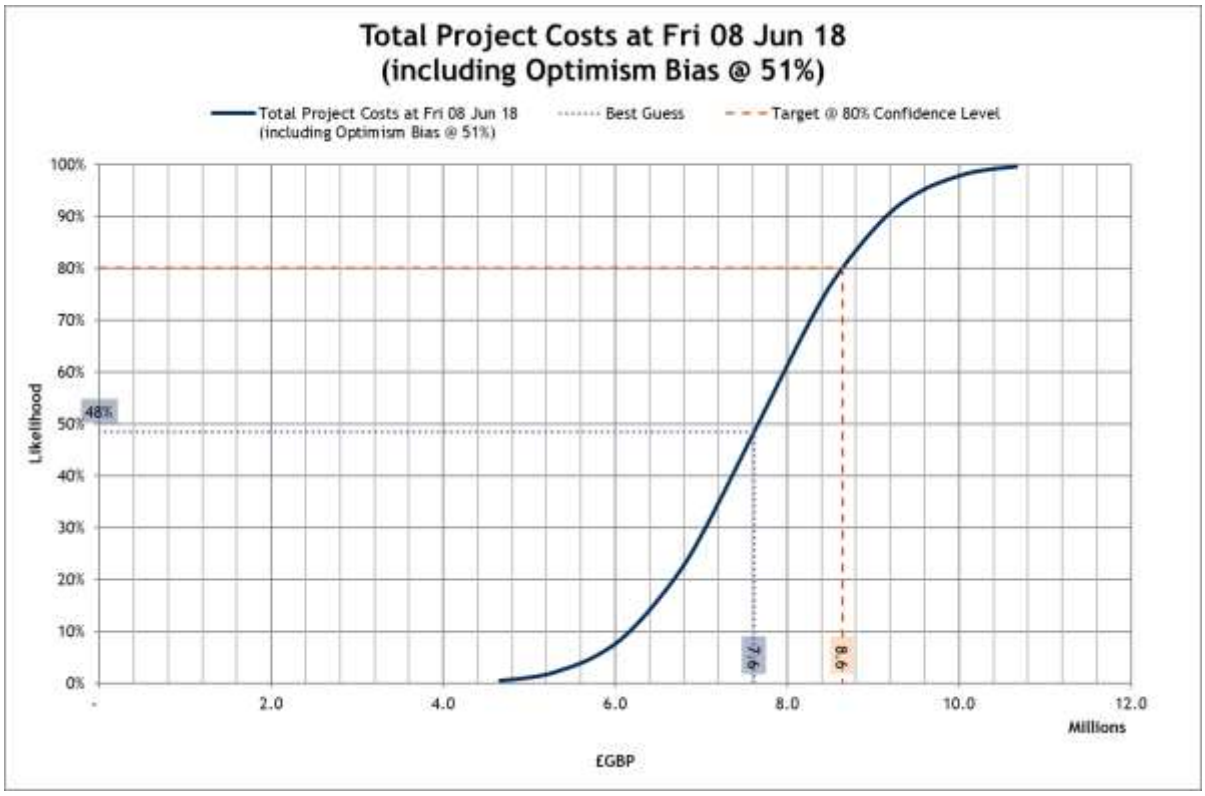


FIGURE 17: 'S-CURVE' OF OPTION E PROJECT COSTS INCLUDING OPTIMISM BIAS AT 51%

As with Option D, we have prepared a high-level cost estimate commensurate with the concept level of design work undertaken to date and developed a cost range as illustrated in Figure 18. This also includes the industry standard 'Optimism Bias' (see Appendix B1 Optimism Bias) for this stage and type of project of 51%.

The probability range for Option E illustrates that our 'Best Guess' point estimate is currently £7.6m, and that we consider there is statistically a 48% chance that the project will be delivered for this cost or less. Since this level of confidence is probably too low for most funders, we have illustrated the level of budget required for an 80% confidence level (P80), which can be seen to be £8.6m. We would recommend that this P80 estimate is the one adopted in further correspondence.

The breakdown of the costs is the same as that shown in Figure 14: Breakdown of Option D costs

because the assumptions for allowances have not changed from Option D for this option.

The top five most influential cost items in the Measured Direct costs are, in order:

1. Turnouts
2. Electrification
3. Signalling
4. New track
5. Platform decking

These represent the items where the quantum and variability of cost have the greatest influence on the final price and therefore give the priority for attention at the next stage of design.

5.5 Comparative cost assessment

Whether the saving of £1.3m (approx. 13%) for Option E against option D is enough to offset the cost of operational vulnerabilities over the assessment horizon remains to be tested at later stages of the project.

The cost ranges of each option are largely dictated by features common to both and improving the design and cost understanding for both designs is likely to result in similar refinements to the cost range.

It is the differentiating factors such as the extent and cost of the ramps, and the time lost in waiting on the loop or time taken to walk to houses to the West of the station that are likely to swing the balance of cost-benefit analysis in favour of one option over another. However, at this stage, we have the costs for both at a similar level of design and estimation accuracy, and the overall merits of one over the other will be dependent on the assessment of relative benefits in due course.

6 Scheme Benefits

6.1 Types of Benefit

Assessment of this project is somewhat complicated by its provision of a wide variety of types of benefit, which are often valued in different ways. This section sets out the sorts of benefit being provided, and the general approach to valuing them, in order to see if the scheme is indeed 'worthwhile' (however that might be defined).

In any appraisal, it is important to understand what will happen if the project does not go ahead. Here, the 'do nothing' is indeed a status quo in which there is neither service improvement nor deterioration, but where base demand rises as local population and employment increase, not least from specific developments around Watford Junction station.

Waiting Times

A simple method of understanding the impact of a reduction in these would be to use a theoretical approach to estimate the proportionate impact of a reduction in waiting time, and to apply the relevant response rate. However, results will vary considerably by the different origins and destinations of trips, which led to the development of a model to provide a greater understanding.

One might also argue that the reduction in waiting times would have a proportionately-greater impact than suggested above, because there can be additional benefits relating to service regularity, benefits which are provide by a half-hourly service but not by one which runs every 45 minutes (so is at different 'times past the hour' in different hours).

Improved Access

The suggested design for Bricket Wood also includes improvements to access, but these are very minor in the overall context, and have not been specifically included in our analysis.

Wider Economic/Social Benefits

Increased access and reduced waiting times will both make the railway service more useful, and enable local people to access jobs, shopping and other facilities, in St Albans, Watford and London. All of these have a positive wider socio-economic value, which could be explored in greater detail in more detailed work. However, this part of Hertfordshire is neither unduly socially-deprived nor distant from employment or shopping opportunities, so these benefits are thought to be small.

6.2 Demand and Revenue Modelling

Introduction

There is a range of available types of model to estimate demand and revenue for new rail services, and these are summarised in Appendix C. For the reasons given there, to assist with the assessment of the benefits, a multi-modal demand model was assembled, using the GCOST™ approach developed by the Railway Consultancy. This model is a spreadsheet-based model which considers the difficulty of travel (technically, "generalised cost") between a range of relevant local and more distant locations, and allocates traffic between them on the basis of the relative difference in generalised costs, using a logit model. Base data on trip patterns has been updated using known changes to residential and commercial development within the catchment of the Abbey line.

The Demand Model and it's Application

Level of Aggregation

Given the pre-feasibility nature of this study, analysis was conducted on 20 representative zones, of which 10 were on or about the line (including one around each station) and the other 10 more distant.

Trips between all 20 and the other 19 zones have been modelled. It is theoretically possible for the Abbey line to be used by other people, but such trips would have to be extremely obscure (e.g. from beyond Southampton to North of Bedford, via Watford and changing stations in St Albans), and therefore we consider these of little consequence.

The model also importantly considers different categories of people, being disaggregated between peak and offpeak passengers, and those with and without a car available for their journey. Data on the number of Economically-Active people and household car availability was taken from the Census, with wards being allocated to stations as shown in Figures 19 and 20.

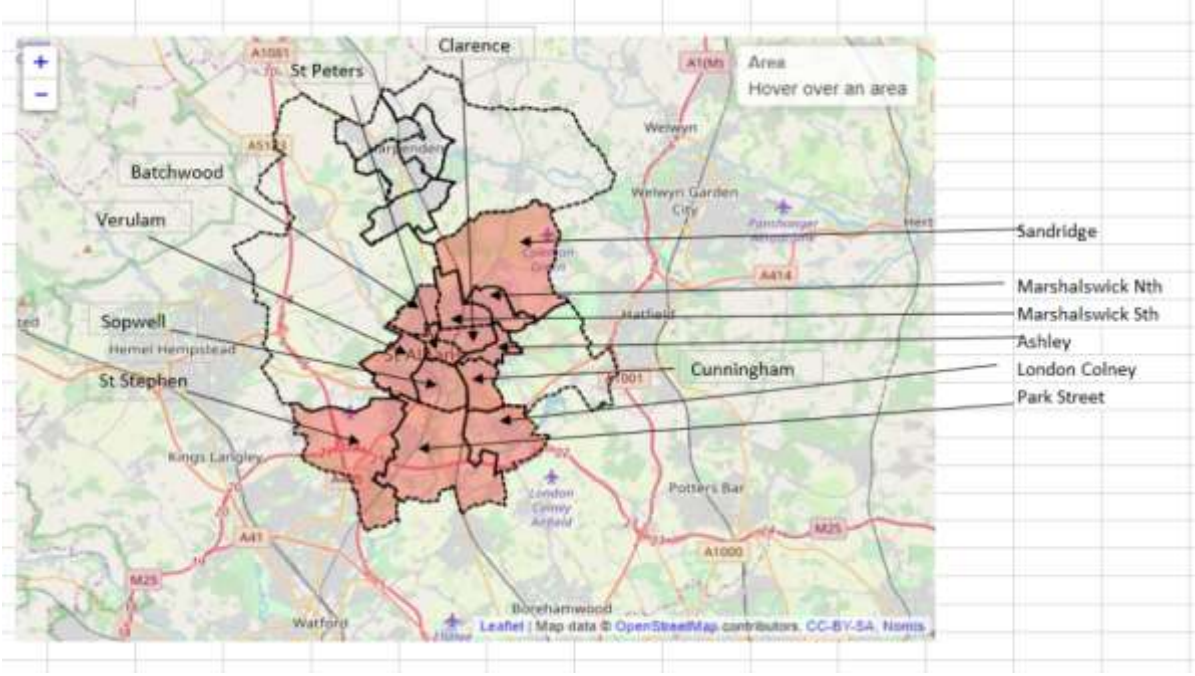


FIGURE 18: RELEVANT WARDS, ST ALBANS

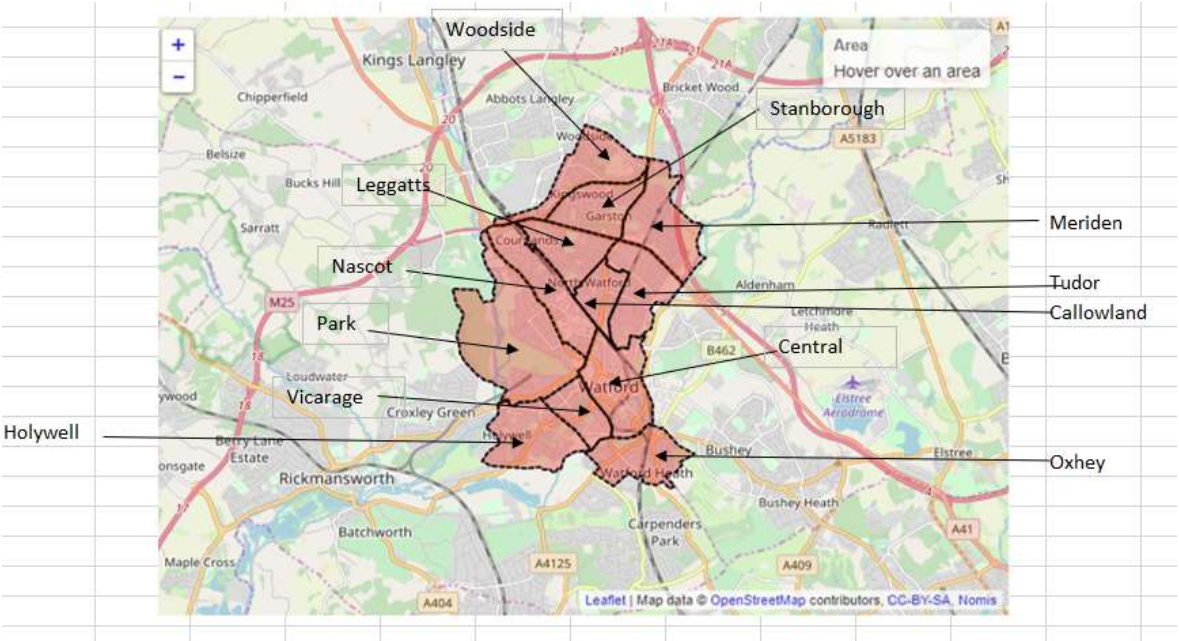


FIGURE 20: RELEVANT WARDS, WATFORD

Generalised Cost data

This was assembled manually for trips by the three key modes of car, bus and train between all 20 zones and each other. Data included that on access and egress (e.g. to/from bus stops and stations), waiting time, in-vehicle journey time, the number of interchanges required, the fare paid, and a mode constant reflecting typical preferences for one mode over another (usually, car preferred to train preferred to bus).

Trip Pattern data

The base trip matrix was derived from the Travel-To-Work (TTW) data shown in the 2011 census data. Although the Census data is now quite old, it is not thought that there have been huge changes in trip *patterns* in this area: Watford, St Albans and London will remain the key destinations for local people. The TTW data classifies people currently resident in each local authority area of the UK by method of travel to work and shows the movement between their local authority of residence and workplace.

Unfortunately, the dataset at its lowest output level is presented at district level which covers a larger area than the trip matrix zones created. Thus, there is need to proportion district output areas into zones. For example, the Watford Census output area covers the station catchments of Watford Jc, Watford North and Garston, amongst others. In order to proportion trip data into our matrix zones, Economic Activity and Workplace population census data by wards were retrieved. This then enabled the percentages of economically-active and workplace percentages by ward in the Watford area to be calculated. These wards were allocated to our trip matrix zones thereby allowing a split of the Watford output area by proportions that represents the relative economic activity of trip-matrix zones.

Model Function

The model compares the generalised cost of travel by the three modes of transport, and allocates traffic to them on the basis of the relative difficulty of travel by each. The function used to do this is a logit function, which is widely-used for this purpose in transport planning. It has the property of allocating broadly-equal mode shares to modes which are of similar quality, but a dominant proportion of traffic to modes which are clearly superior to others. The constant term in the model controls the extent to which apparently-inferior modes receive traffic.

Calibration

Transport planning models should never be used to forecast future demand unless they can reflect existing conditions. We therefore spent considerable time calibrating the model, using as our calibration targets the station-by-station demand figures provided by ORR for 2017-18. However, these are known to be under-estimates (especially on the Abbey line, where ticketless travel is a significant issue), so we were relaxed about achieving estimates of current demand 10-20% above the current officially-reported figures.

Nevertheless, we did have to make a temporal adjustment to the base trip pattern data, since that was derived from the 2011 Census. Mid-year population estimates for 2017 were also available from the Census, which showed that the 15-69 population across the borough of Watford had increased from 64,961 to 67,329 (a 3.6 % increase) whilst the equivalent figures for St Albans DC were 97,062 and 98,073 (a 1.0% increase). A nominal 2% increase was applied for all other traffic origins.

Calibration requires the adjustment of various parameters, in order to replicate as closely as possible the observed conditions. Parameters adjusted here included those of parking charges, and the logit model parameter (which governs the extent to which people choose what appears to be the second-best travel option).

Two further particular features of the calibration are worth remarking upon. First, the modal constant used to define people's generic preference for one mode over another showed that the Abbey line is not considered by many to be significantly better than alternative bus mode – presumably because of its odd timetable interval and relatively high level of cancellations. Secondly, it became clear that the line's traffic potential is significantly affected by the ability of local retired people to use pensioners' free bus passes on the parallel bus routes.

Whilst the method gave a reasonable base for expected trip patterns between zones, there was need for further adjustment, to make sure trips aren't over/under estimated. It is fair to assume that not all residents within a ward will use the "nearest" station. Factors such as living on the wrong side of the railway or being too far from a specific station may mean some will use another more conveniently located station – or not at all. This was all considered when adjusting proportions to help create a trip matrix that reflected reality. Overall, it appears that the catchment areas of Abbey line stations are relatively small.

Whilst reasonable calibration was achieved, it must be understood that demand forecasting attempts to replicate complex human behaviour, so all forecasts must be treated with caution.

Trip Matrix Development

However, 2011 data is now out-of-date in terms of its absolute values, and needed to be updated. As noted above, this was achieved by using the 2017 Census mid-year estimates to multiply up the 2011 ward data by the % increase in adult population at borough level

On the basis that any scheme would take several years to implement, we have sought to produce a near-future trip matrix which reflects expected short-term demand growth, both for population and employment, and both in terms of background growth and that associated with specific local developments.

ONS population projections for the period 2016-26 indicate an average increase of 6.4% for South East England (outside London). Equivalent figures have been used for other regions. The SE England average increase has been assumed for any local areas for which we do not have more accurate information. However, based on a wide range of local development plan and applications data provided by Abfly (see section 2), we have spent considerable time calculating the likely increase in population immediately around the line.

Because of uncertainties beyond that date, we have not considered further population increases.

Two sites are of particular interest in generating potential trip destinations: those at Clarendon House (33 Bridle Path, 1800 m2 of offices) and 37-39 Clarendon Road (c. 11,100 m2 of offices); both of these are very close to Watford Junction station. Even at a relatively-large amount of space per employee (say 150 sq ft/person), the former of these is expected to lead to c. 130 extra jobs, and the latter 800.

A future base model was therefore constructed, containing the expected future levels of demand but the current levels of service.

Application

Replacement data-sets contained the changed waiting and in-vehicle times were therefore prepared. These data-sets were input into the model, and compared with the existing level-of-service data. The results reflect the three key benefits of transport schemes: demand, revenues and time savings. Other benefits can be derived if necessary, from the zone-to-zone data calculations, but these tend to be of less significance in transport scheme appraisal.

Results

The first stage of modelling reflected the application of the higher numbers of passengers expected to use the line in the future, as a result of background and development-specific growth. The second stage applied the proposed changes to train service. It is important to understand that only the latter can be counted as directly-consequential benefits to the scheme.

If a passing loop were to be provided at Bricket Wood, it would be possible to increase train service frequencies, as a result of which waiting times would fall. This is particularly important, as the existing waiting times are relatively long and we know from research that passengers disproportionately dislike waiting time (waiting time generally being dis-valued twice as much as in-vehicle time).

However, for those passengers travelling through Bricket Wood, there would be a time penalty, whilst the two trains crossed. We have estimated this as 3 minutes. Fortunately, this is considerably less than the saving in waiting time, so the scheme does provide net benefits. We present our indicative results below. Note that we have separated out the impacts of background growth, installing the passing loop and getting transfers from bus and car, and generating entirely new trips; this is because such different types of trips can be treated differently by Government in the appraisal process.

Scenario	Demand ('000 pass. p.a.)	Revenue (£m p.a.)	Value of Time Savings (£m p.a.)
Current base (ORR)	240		
Current base (modelled)	252	1.37	
Future base	303	1.62	
With passing loop at BW	381	1.88	0.15
Including potential extra generated traffic	670	2.35	

TABLE 7: DEMAND MODELLING RESULTS

N.B. All figures adjusted to include an estimate of the number of passengers travelling to/from but not via Watford Junction. The absolute figures noted above represent those modelled, which will not be exactly the same as demand and revenue on the line itself: for instance, revenues will include that attributable to the whole journey made by a person living next to the Abbey line. Figures are only quoted to this level of accuracy, in order that the magnitude of small changes may be seen; in practice, results should only be given to 2 significant figures.

7 Appraisal

The main objective of the investment options considered here is to increase passenger demand and revenue by increasing train service frequency from its currently-unattractive 45-minute intervals.

7.1 Operational Costing

Running extra trains would obviously incur costs, the main headings of which are:

- additional traincrew;
- extra track access costs; and
- the leasing, maintenance & cleaning of an additional trainset.

Without conducting a full crew rostering exercise, we judge that the enhanced level of service would require three extra sets of traincrew, and note that the employment costs of each driver and conductor together are c. £100,000 p.a. Using TOC-derived data from the last year of London Midland operation (the latest relevant available), extra track access is estimated to be c. £160,000, rolling stock leasing c. £150,000, and maintenance broadly-similar; combined with fuel costs shows that the extra mileage would probably cost around £800,000 p.a. in total. We have compared this 'bottom-up' basis to average LM costs, and can confirm that the £800k figure is clearly rather less than use of their average costs would imply (e.g. because HQ and station costs, amongst others, would remain unchanged).

7.2 Appraisal Parameters

This appraisal has been undertaken to be as compliant with webtag, the Department for Transport's web-based guidance, as possible. The appraisal is based on the difference between the 'future base' and 'with passing loop at BW' rows of Table 7.

The appraisal makes conventional assumptions about projects being discounted over a life-time of 60 years, at rates of 3.5% p.a. for years 1-30 and 3% p.a. for years 31-60. The discounting means that a one-year recurring cost of £x is worth £19.75x over the 60 years. However, applying the expected traffic growth, but also a typical traffic ramp-up curve (to reflect the way in which passengers take some years to respond to improvements[3]) and expected increases in VoTT, demand of £x is worth £21.79x and a time benefit of £x worth £30.43x over the 60 years. This is because relative increases in the Value of Travel Time have been assumed, in line with DfT forecasts.

Analysis at an even more detailed level could be carried out at a subsequent stage, but may not be appropriate for a relatively-small scheme such as this. For instance, one might assume that 60% of new rail trips in the area are abstracted from car, which has environmental and traffic congestion benefits, but loses the Government a small amount of indirect tax; none of those second-order effects are included here.

7.3 Appraisal

In order to be able correctly to compare one-off costs with ongoing costs and benefits, we have used discounted cashflow analysis. The ways in which future costs, revenues and time savings are to be discounted for public sector investments is stipulated by the Treasury (in "the Green Book"), with specific rail-based examples and application provided by the Department for Transport (through the

[3] We have assumed that only 50% of benefits accrue in year 1, 75% in year 2 and 90% in year 3, with the full impact of new facilities and their associated demand only becoming apparent from year 4.

webtag analysis methods). We have applied these to option D in a technical spreadsheet, of which Table 8 is the summary page.

Abfly Passing Loop Option Assessment			
		One-off/ annual	NPV factor	NPV
		£k		£k
New facilities				
Construction costs		-8600	1.00	-8600
Extra train operating costs		-800	19.75	-15800
Extra cleaning costs		-10	19.75	-198
Extra maintenance costs		-50	19.75	-988
Commercial income				
Additional rail revenue		260	21.79	5665
Financial case				***-19920***
Passenger time saving benefit		150	30.43	4565
Road decongestion benefit		26	47.37	1227
Economic case				***-14129***
Benefit:Cost ratio				***not calculable***

TABLE 8: BRICKET WOOD PASSING LOOP APPRAISAL SUMMARY

As can be seen, the results are somewhat disappointing. Whilst significant extra demand (hence revenue and time savings) is expected, sufficient to cover the construction costs of the cost-minimised option developed as part of this work, its value does not cover the extra operating costs, notably those associated with a second trainset.

7.4 Discussion and Next Steps

On reflection, our results are unsurprising. Rail operating costs on the branch are not being fully covered now (as one would expect more generally of a British railway branch line in 2019) – the line is being subsidised. Operating costs will clearly increase with increased service; the proposed service here increases train miles by 50% (from 4 trains in 3 hours to 6 trains in 3 hours). Although there would be some efficiency savings (potentially in traincrew utilisation) with a higher-frequency service, the number of trainsets needed will need to double, so costs will rise significantly. Paying for this would only be possible if the increase in demand and revenue was at least as great as the increase in operating costs, but this is generically unlikely (given that service frequency is only one element of passengers' journeys by rail).

The value of time savings and other benefits generated from improving the line therefore need to cover, not only the capital costs of any works, but also the increased operating shortfall. Even if the former of those have been minimised (as this project has demonstrated is possible), they struggle to cope with the latter.

This leads to a consideration of how the operating shortfall might be reduced. Two costs seem to us to be relatively high. First, vehicle leasing and maintenance costs are disproportionately high because

4-car trains are leased for a line with a maximum trainload of about 150 passengers – who could fit into two carriages. However, any search for a replacement type of train needs to take into account the following:

(i) The minimum train size on this line needs to be able to cope with 150 passengers, so some of the cheapest options (e.g. Parry People-mover vehicles) simply do not have the capacity required;

(ii) The only existing 2-car (Electric Multiple Units (EMUs) in Britain are being used for train lengthening for South Western, and they are dc 3rd rail-only versions not originally designed for conversion to ac overhead traction;

(iii) The costs of adapting any older longer designs are unlikely to be trivial, since it is usual in longer multiple unit trains for the traction gear not to be housed in the end vehicles;

(iv) Any train types selected would incur significant extra overhead depot costs (e.g. spares, maintenance knowledge) if not of a design already familiar to/being maintained by the appropriate depot (here, Bletchley);

This seems to lead to possibilities being either the 3-car Class 323s currently used by London Midland in the Birmingham area (although we understand that most, if not all, of these are being transferred to Greater Manchester), or an electric variant of the Class 230 Vivarail train, of which diesel versions are currently being acquired for the Bletchley-Bedford line. Whilst our advice would be for both of these options to be investigated at a high level, we are aware that Vivarail are positively interested in this opportunity, so we recommend that they are contacted as soon as possible – not least because use of shorter trains could reduce leasing costs and thereby improve the existing economics of the line.

The other disproportionate cost element is that of the conductors. The role of these staff on the Abbey line focusses on opening and shutting the doors, after which it is very difficult to collect fares and/or offer any customer service, as the stations are too close together to do so. Although conversion to driver-only-operation clearly has political and industrial relations risks, it would permit the on-train member of staff to collect a greater proportion of the revenues, thereby increasing the line's income.

On the income side, we note that the availability of free travel to pensioners on competing local bus services is a recognised problem for local rail services around the country. One study we are aware of noted a 20% reduction in local rail demand when free bus travel was introduced. Income on the Abbey line is therefore lower than it might be, which further prejudices the economics.

However, a sensitivity analysis of our appraisal shows that, even if the operating costs were reduced by £0.25m p.a. and the income increased by a similar amount, the scheme would still not achieve the desired appraisal result.

8 Conclusions, Recommendations and Next Steps

8.1 Conclusions

The Watford Jc – St Albans Abbey rail line is currently hampered by a lack of a passing place. Because of continuing local residential development, service levels (generally of 45-minute frequency) are increasingly regarded as inadequate, but require a passing place if this frequency is to be improved. Five options have been examined as possible sites for this loop, and those at Bricket Wood station were found to be the best. A range of works, covering turnouts, track, electrification, signalling, and platforms would be needed to deliver this. Using a conventional design of passing loop with separate platforms for traffic in each direction, there is an 80% probability of delivering these works for just under £10m, but a more unorthodox design with a single long platform split into two (as used at Penryn, in Cornwall) could reduce this cost by over £1m. Both solutions have included careful thought about how to minimise signalling costs, and therefore come with associated restrictions on train service set-up/shut-down and recovery.

A preliminary costing of the train service, however, shows that the extra mileage would probably cost around £800,000 p.a. There are two main reasons why the costs are unhelpfully high:
(a) 4-car trains are in operation, whereas we really only need 2-car sets (but there aren't any electric ones of those, although we might mention amended versions of VivaRail's Class 230s, diesel versions of which are to be used on the Bletchley-Bedford line?)
(b) we're incurring the costs of 2-person traincrews, even though the conductor role adds a lot of cost and not much value, as they don't have time either to check tickets properly nor offer customer service.
It would appear that the economic value of the increased passenger revenue and passenger time savings resulting from the improvement in service frequency from every 45 minutes to every 30 minutes is likely to cover the capital costs of works, as described above. Unfortunately, it is certainly not able to cover the extra operating costs, since (for instance) an extra trainset and three more traincrews would be needed. This result is not unsurprising: the Abbey line is currently in receipt of subsidy because it does not cover its operating costs, so a further increase in costs would have to lead to a very significant passenger response in order to improve matters. As waiting times are only part of passengers' journeys, and because the scheme (in order to minimise capital expenditure) requires trains to wait whilst passing, there is a small increase in journey times for passengers travelling through Bricket Wood, the benefits are simply not large enough to provide the response required.

So, whilst the scheme has considerable merit with associated economic benefits, at present these do not seem large enough to lead immediately to a decision to proceed.

8.2 Recommendations

This project has clearly identified a scheme variant which is more cost-effective than many other proposals for this line. We have also identified indicative operating costs, and this suggests that there may be some value (for the continuation of existing operations, as well as future ones) in investigating ways of reducing these costs.

Whilst other rail schemes have progressed elsewhere on a similar level of economic appraisal, these have been successfully-promoted on the basis of supporting regeneration and accessibility to key employment centres. However, whilst none of those criteria are particularly applicable to the situation of the Abbey line, there is still some potential for taking this forward politically or to support other

policy objectives – for instance, in comparison with other, road-based, schemes which may be seen to be unaffordable or environmentally-unacceptable.

8.3 Next steps

Railway planning is an iterative process, so refinements to calculations are usual. On a technical level, the next steps should perhaps include more detailed investigations into the top five most influential capital cost items described above, in order to refine the cost estimates. The next stage should also attend to the risks and opportunities identified to reduce the former and increase the latter as much as is practicable within the confines of the study.

The next stage of technical work might also aim to include open dialogue with Network Rail in order to obtain information about the condition and plans for specific assets. It is likely that this work will require their formal engagement through an Asset Protection Agreement (an 'APA' or 'AssPro'), which can be expensive. Further progress on this design can be made without their involvement, but this will mean some risks will remain unquantified or unknown until that point.

On the policy and political side, the results demonstrated in this report need to be brought to the attention of those developing transport policy within the area. The figures developed here need to be compared to some of the other aspirations for local transport improvements (e.g. road enhancements or a guided busway), to put them into context: a passing loop at Bricket Wood is clearly practically-achievable in the near future, and at relatively low cost. The rail option fully supports the objectives set out in local policy documents (see section 2), so the sources of funding available to support those policies should be investigated as ways of enabling this project. We note, in particular, the scale of the proposed housing development at Radlett Aerodrome and hence the planning gain resulting from it.

Against a background of progress of similar small rail developments elsewhere in the country, we would hope that this project can also move forward (despite its relatively-weak Cost:Benefit ratio), given appropriate local political and community support.

Appendix A Signalling and operational strategy

A 1 Introduction

These notes have been prepared on the basis of technical advice provided by Kilborn Consulting which we have simplified further here for the lay reader. The objective was to identify a signalling solution at lowest cost to the project, examining two specific variants - traditional and next-generation.

A 1.1 Traditional signalling

The first is a solution using traditional signalling principles such as Solid State Interlocking (SSI) or Computer Based Interlocking (CBI), which both depend on lineside signals. The existing signalling at Watford Junction is understood to be a SSI system, which is progressively being replaced across the country by CBI systems.

Although it may be possible to save some costs by re-using parts salvaged from decommissioning activity elsewhere on the network, other factors to consider are the reducing number of people with experience in installing and maintaining such systems, and the cost implications of changes in the control centre as well as the lineside equipment. Even small additions have to be evaluated for their impact on the signaller's workload, and if it is 'the straw that breaks the camel's back', it can trigger the cost of additional signalling staff which is a long term operational cost.

A 1.2 Next-generation signalling

The second signalling system is a Cab Based Train Control (CBTC) system which provides Movement Authority and speed advice to the driver through an in-cab display. It depends on radio-based communication systems to determine the type, location and speed of each train on the network and uses that information to advise drivers what action to take.

The European Train Control System (ETCS) Level 2 which provides cab-based advice but uses track detection systems to determine train location is only just being rolled out in Europe. Level 3 removes the need for track-based detection systems and is still under development and trial.

The benefits of Level 2 and particularly Level 3 signalling are intended to be the more efficient use of trains on a congested network, allowing trains to be sequenced closer together. On this route, such benefits are likely to be minimal and therefore Level 2/3 is not necessary to generate efficiency benefits.

However, the features of this project make it an attractive option for a live trial system:

- Short length railway – so limited infrastructure (radio mast) costs
- No tunnels – so GPS-based location can be used without complication
- No interconnecting railways – so no operational pollution from other services
- No freight – so no long, heavy trains with different braking patterns to allow for
- Consistent train units – so all vehicles are one type, making calculations easy
- Limited vehicles on the system – so very few vehicles (perhaps 4 or 5) need to be fitted out
- No large gradients – so braking calculations are easy
- One level crossing – allowing testing of the system with a manageable number of level crossings

The hope is that if the UK's Digital Railway or potential Level 3 Manufacturers can be persuaded to adopt this project to demonstrate their equipment in the hope of winning much larger contracts elsewhere, then the system may be provided free or at nominal charge to the project.

A 2 Strategy

A 2.1 Next-generation signalling option evaluation

Kilborn Consulting has evaluated both of these generic options and concluded that although the next-generation signalling approach would be ideal, the current trend in Network Rail's Digital Railway programme is to focus on improvements to the control centre traffic management system because this is anticipated to give best value for money. Other lines have already been identified for ETCS testing and it seems unlikely that a new trial site would be adopted in line with the timings for this project whenever it goes ahead. Therefore it seems that

although it could be worth lobbying manufacturers and Digital Railway just in case, this is a risky strategy to commit to.

A 2.2 Traditional signalling

There are sub-variants to a traditional signalling solution, but we have focussed on a solution designed to avoid changes to the signalling control centre and hence removing the risk of control centre and staffing costs. This is achieved through the creation of a 'signalling island' that is automatically controlled without need for oversight by the local signaller at Wembley. This approach is valid for both Options D and E, though we have used Option D for illustration the principle is the same.

In this option there are four track sections, controlled by axle-counters (or possibly track circuits within the loops):

- Watford Junction to the London End of the loop
- St Albans Abbey to the Country End of the loop
- The Down Loop (northbound)
- The Up Loop (southbound)

New colour-aspect signals are provided in advance of each track section break point. Points would be set to ensure that each loop track is one-way i.e. northbound trains go to the west loop, and southbound trains to the east loop.

A 2.2.1 Normal passenger operations

During normal passenger operations, four-car trains would depart from opposite ends of the route i.e. Watford Junction and St Albans Abbey at approximately the same time. Each would have signalled clearance to approach the loop and continue on to the end of the loop where it would stop in the platform until the single line ahead is shown clear.

Shortly after a train enters the loop, the single line section behind it will be cleared so that the train in the other loop can travel into it. Both trains then continue on into the single line sections to the other end of the line where they can stop and then repeat the exercise in reverse.

A 2.2.2 Start of the day

The complex part of this strategy is how to get two 4-car units into and out of the line such that each train only has permission to move when the line ahead is definitely clear. At the moment, each train is directed by the signaller from the depot to the Abbey Line, where the driver has a 'token' to prove that their train is the only train on that route. The token is handed back at the end of the day. If we are to avoid signalling control for the whole route, then movement authority still has to be controlled even without a signaller.

Our proposal is to bring both trains in together as a single 8-car train. The driver of the lead train ("Train A") takes the token. The driver of the attached train ("Train B") remains in their cab.

The A+B train travels to Bricket Wood as an Empty Coaching Stock (ECS) move (i.e. without passengers). At Bricket Wood, the A+B train splits into separate trains A and B. Train A then departs for St Albans Abbey.

As soon as it enters the single line section to St Albans Abbey, the protecting signal on the Bricket Wood Down (northbound) platform will turn red so the driver of Train B cannot accidentally proceed beyond the end of the platform, though Train B will move forward to the end of the platform ready to enter service.

Train A can enter service from St Albans Abbey and will have signalled movement authority into the Bricket Wood Up (southbound) platform (and beyond to Watford Junction). When Train A is in the Up platform at Bricket Wood, and Train B is in the Down platform, Train B can also depart as a passenger service. Each then begins their cyclical routine through the day.

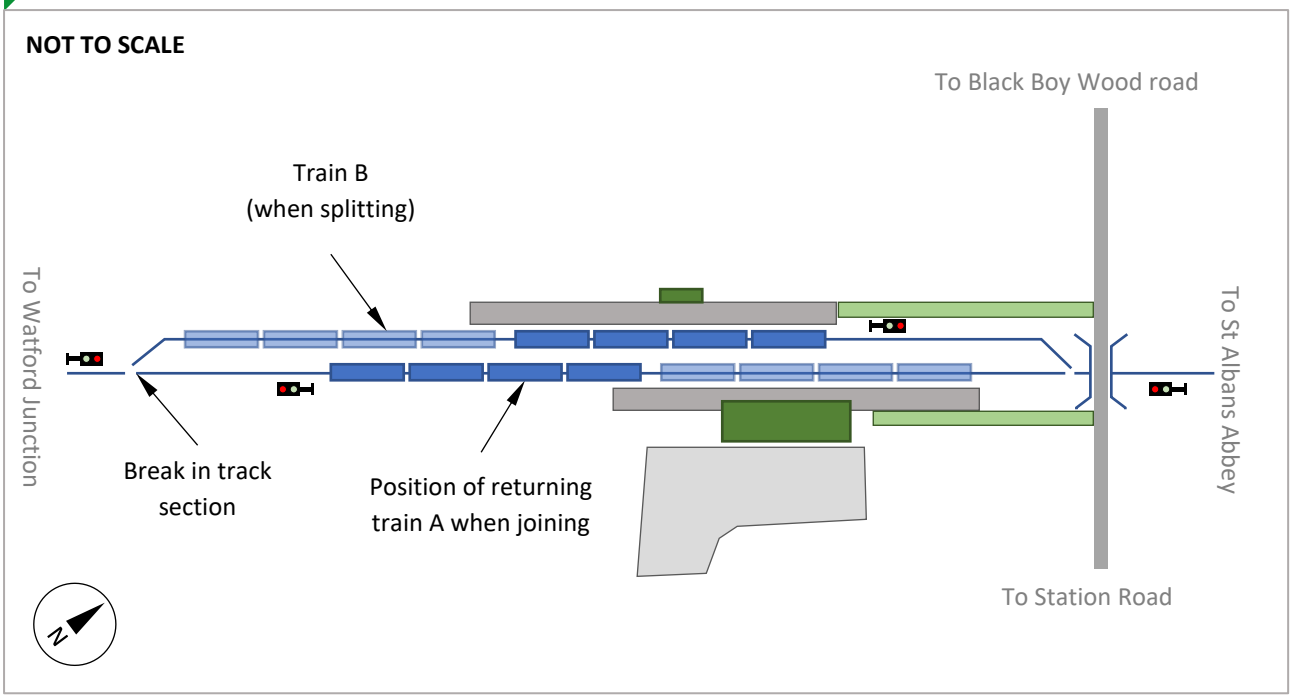


FIGURE 21: SCHEMATIC OF SIGNALLING SOLUTION (USING OPTION D AS AN EXAMPLE)

A 2.2.3 End of the day

At the end of the day, both trains must return to Bricket Wood – Train A in the Up platform, Train B in the Down platform – and all passengers must disembark from Train A.

Train B continues on to St Albans Abbey where all passengers disembark and the train comes out of service. The remaining moves of the day are ECS moves. Train B returns, stopping at the signal protecting the Up loop. Meanwhile, Train A pulls forward to the signal on the up loop. The driver would then execute a Calling On procedure by operating a one-time operation push button in a secure locked cabinet for operation by the driver of the first train to clear a subsidiary aspect on the protecting signal.

The Calling On would allow the Train B driver to approach Train A at very low speed. As Train B clears the St Albans Abbey section, the signal behind it would revert to normal operation. Once both trains A and B are in the Up loop section, they can be joined together using normal procedures as in a depot or terminus, at which point it is a single 'A+B' train. The driver of Train A still has the token, and is able to drive as an A+B train back to Watford Junction where the token can be handed back as it leaves the Abbey Line.

A 2.2.4 Recovery of defective vehicles

In the event of one of the trains failing now, a recovery train leaves the depot at Northampton and rescues the defective train on the Abbey Line, taking it to Northampton before returning to then take over the Abbey Line service. This is a very time consuming and frustrating exercise for passengers.

In the event of a failed train with two trains on the system, the following approach is proposed, but would be subject to detailed discussion with the operator.

Once a train is declared as needing to be taken out of service (Train A), the other train (Train B) would also need to be taken out of service temporarily as soon as is practicable, probably at either St Albans Abbey or Watford Junction. It would then return to be used as a rescue train in a similar manner to that which occurs currently. It would take the failed train to Watford Junction and normally use one of the vacant electrified sidings. It would then return into service and run as a single train does now until the end of the day. Meanwhile, the operator could send a rescue vehicle down from the depot at Northampton to collect the failed train and bring it to the depot for repairs.

Although this leaves the Abbey line with a reduced service for the rest of the day (we think it is likely to be too disruptive to reinstate a two-train service in the middle of the day) it does at least restore a service much quicker than is currently the case.

A 2.3 Outcomes

With the proposed approach, there would be no need for signaller intervention, other than for the train entering or leaving, as is believed to be the case at present and therefore signaller workload impacts should not be an issue. There would also be no need for the 'signalling island' at Bricket Wood to interact with the rest of the NR signalling system and no need to amend the NR signalling.

However, the potential problems include: -

- The required length of the loop to accommodate splitting and joining – which has now been incorporated in the design and costs
- Staff concerns over the change in train operation, this should not be underestimated and needs careful handling
- Train Operating Company acceptance
- Obtaining approval for novel operation

On balance, we therefore consider this is likely to be the most cost-effective approach we can propose that meets the criteria.

Appendix B Cost pricing notes

B1 Optimism Bias

Optimism Bias is a much-misunderstood concept and is not the same as risk or contingency. It is a means by which the calculated and risk-adjusted costs are increased by a factor that recognises that projects of this type statistically increase from their early estimates by about this amount. Whereas cost estimates and risks are calculated – as here – based on a prescribed set of works, this is only accounting for the 'known knowns' (the things we know we know) and the 'known unknowns' (the things we know we don't know).

Optimism Bias recognises that at the very early stages of projects there are 'unknown unknowns', which are the things we don't know we don't know. The reason that these are unknown is simply a function of the limited time, budget, site investigations and stakeholder engagement thus far, and that such matters can often reveal issues that could not have been foreseen in the early stages of a project.

Nevertheless, Government guidance is that while projects may adopt the risk-adjusted figure before Optimism Bias for project management purposes, the full estimate including Optimism Bias is the figure to be used for business case development when applying for Government funding, and therefore we have shown this amount represented as a probability range.

B2 Cost categories

The following terms are used to describe the ways in which different parts of the cost build up are included.

Term	Typical contents
Measured Direct Costs	These are the construction costs built up on a quantities x rates basis. It will include all items for which a specific quantity has been determined
Additional Direct Cost Allowances	An allowance for general more detailed items not measured because it would take a disproportionate time to develop the detail required to develop unit rates or quantities relative to the improvement in accuracy gained
Indirect costs	These are the costs relating to enabling work such as design, contractor preliminaries (site accommodation, access, security, admin, attendant labour, plant, temporary works, health & safety, insurance etc.), project management, possessions, compensations, and Network Rail Asset Protection
Land and property costs	Land take, compensation, environmental and consultation and legal costs
Optimism Bias	Allowance for 'unknown unknowns'

TABLE 9: EXPLANATION OF COST CATEGORIES

B3 Assumptions

We have outlined the major design assumptions within the text of this report.

- Costs are stated at 2018 prices
- Unit rates are in some cases based on historical rates uplifted by the Rail Cost Index produced by the Building Cost Information Service (BCIS) from the Royal Institution of Chartered Surveyors (RICS)
- Unit rates have been based on a range of sources from supplier quotes to other publicly available project estimates. Where we are uncertain as to the accuracy of specific unit rates, this is reflected in the cost range and contingency for each line item

- The probability range is determined from a modified 'three-point estimate' approach with data presented as a normalised curve. It is intended to articulate the degree of confidence in both quantity and unit rates accuracy as aggregated up to the overall project. As a statistical representation of one-off projects it would be difficult to 'prove' the accuracy of the approach, however, the process is based on similar accepted industry methods (Gantt chart analysis; Monte Carlo analysis) and is considered reasonable for this stage of design.
- Design would be in accordance with Network Rail standards
- All costs other than Measured Direct costs are considered as percentage allowances based on industry experience and are provisional sums
- Access costs will be reasonable based on normal negotiations with local land owners

B4 Exclusions

There are some types of costs that we have not included within this estimate.

- VAT
- Land purchase or leasing costs
- Costs associated with any resulting train modifications or driver training
- Environmental, geological, or dimensional survey costs
- Environmental protection measures
- Inspection or rehabilitation of track drainage
- Inspection, design or modifications to the existing brick arch footbridge
- New mains or statutory undertakings costs, including temporary diversions
- Maintenance costs

Appendix C Techniques for Estimating Rail Passenger Demand

There are a wide range of techniques for estimating the demand for railway services, ranging in scope, complexity and accuracy. There are two basic approaches – aggregate approaches (top-down methods using market data) and disaggregate approaches (bottom-up methods using data taken from individual passengers and residents).

Trip Rates

Perhaps the simplest way of estimating the demand for a service is through the application of trip rates. For a given size of population, the number of trips may be relatively constant. One might therefore estimate the number of trips at a completely new site from its population. The main problem with this approach is that it does not take into account the distribution of trips. For a railway network, with a limited number of stations and lines, this is a critical issue. If demand is not to the places that the railway serves, the size of the population is virtually irrelevant. Local pressure for stations may need to be resisted if the railway is in an inappropriate direction. For instance, residents of Soham in Cambridgeshire have long campaigned for a station, but trains would run between Ely and Bury St Edmunds. As the favoured destination is Cambridge, which would require a change of trains, the station is unlikely to be successful, and demand estimates based on its population will be misleading.

Gravity Model

The distributional element of trip-making is taken care of in a gravity model. This recognises that trip rates vary by distance as well as the size of population. The formula normally used for it is:

$$T_{ij} = k \cdot \frac{P_i \cdot P_j}{D_{ij}^2}$$

where T_{ij} is the number of trips between places *i* and *j*

P_i and P_j are the populations of the two places

D_{ij}^2 is the distance between the two places

and *k* is a constant.

This method enables rail planners to discern between alternative destinations. If these are not located on the rail network, then rail trips to and from them will not be assumed. However, the primary weakness of this approach is that it takes no account of service quality. In reality, the level of rail trips will also depend upon road speeds on parallel roads. Where roads are substantially improved, rail demand falls off; if the railway is subsequently upgraded, or the road gets congested, rail demand may build up again.

Network Models

In areas where there is a great deal of planning activity, it may make sense for a local authority or transport provider to set up a network model. This will contain information about the current number of trip ends, the networks of the different modes, and the service patterns of different public transport

alternatives. As this data collection exercise is substantial, its costs make it too expensive for most applications outside metropolitan areas.

However, once collected, demand can be assigned across the network very easily, and estimates made of the potential use of new facilities and services. The demand may be assigned between modes using a **logit model**, which allocates traffic dependent upon the difficulty of using them. This latter is usually measured in 'generalised cost', which may be considered by the layman as an index of hassle. To the economist, it represents a measure of disutility. The mode with the least hassle (or least disutility of use) will be that which is favoured in an 'all-or-nothing' model. The logit model, however, is more realistic, in assigning demand across a range of modes, although of course that with the lowest generalised cost gets the largest share. The logit statistical function, however, also allocates significant amounts of traffic to alternatives which are close in generalised cost; conversely, as generalised costs increase, the proportion of traffic forecast to use them falls off steeply.

Stated Preference

The main weakness of a network model is its difficulty in representing qualitative elements e.g. seat comfort, the ability to listen to one's own music, lack of information etc. These issues, which are difficult to quantify, are collectively described as modal preferences. A second problem area associated with network models has been their deterministic nature e.g. if an alternative is better in generalised cost terms, then most traffic will be allocated to it. In reality, however, this may not occur, especially if the potential traveller has no experience of the new alternative. It may be, for instance, that it is intended to introduce a tram system, but most British residents have not travelled on a tram for generations. Its benefits may therefore not be understood.

By describing the constituents of tram travel, however (e.g. the quality of stops, the smoothness of the ride, the appearance of the vehicle), and trading these off against variables which are understood (e.g. fare), it is possible to ascertain valuations of qualitative elements of the journey. Stated Preference analysis is the recognised technique for doing this, but it does require considerable fieldwork and analysis if robust results are to be obtained. SP results fed into a network model whose mode choice is allocated using a logit function would, however, provide the best method available, if resources permitted.

The GCOST™ model

Many schemes and options, however, are only analysed at the feasibility stage. A full SP analysis at this level of detail would be prohibitively expensive. The Railway Consultancy Ltd has therefore developed the GCOST™ model, which is a time-efficient and cost-effective way of analysing options for new stations and services.

The GCOST™ model is a spreadsheet-based model constructed as a series of Excel worksheets (see below). Each of the first five comprises details of an element of the journey, for a range of pairs of key traffic origins (Os) and destinations (Ds). The data is collected separately for peak and offpeak conditions, and for the main modes involved e.g. car, bus, train, park & ride. Journey elements which may be appropriate include access (e.g. walking to the station), waiting, in-vehicle time, the number of interchanges, and public transport fares and car parking charges. The sixth sheet calculates the generalised cost for each O:D pair.

The seventh sheet contains some global information about trips, which can be adapted to the circumstances. It may be that Journey-to-Work data is available from the Census, or perhaps only settlement size data exists, in which case a gravity model would be used to estimate the likely volumes of traffic (by all modes) between Origins and Destinations. Critically, however, the main part of this

sheet comprises a nested logit model, which allocates traffic between the various modes. It does this by 'nesting' similar modes, such as Car type and Public transport type modes, and using LogSum to find the probabilities.

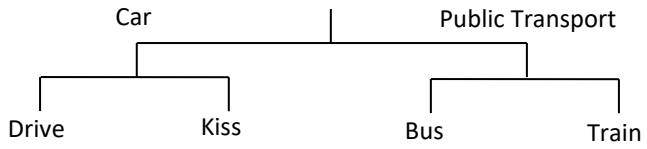


Figure C1. Nested Logit Model Structure

It is calibrated to reproduce existing data – a small-scale survey may be needed here, in order to ensure that the model is working correctly. Once calibrated, however, the model can be used to forecast new situations, by varying the input data to reflect options for the future – perhaps faster services, or a new station. The number of trips on the proposed service is a key output.

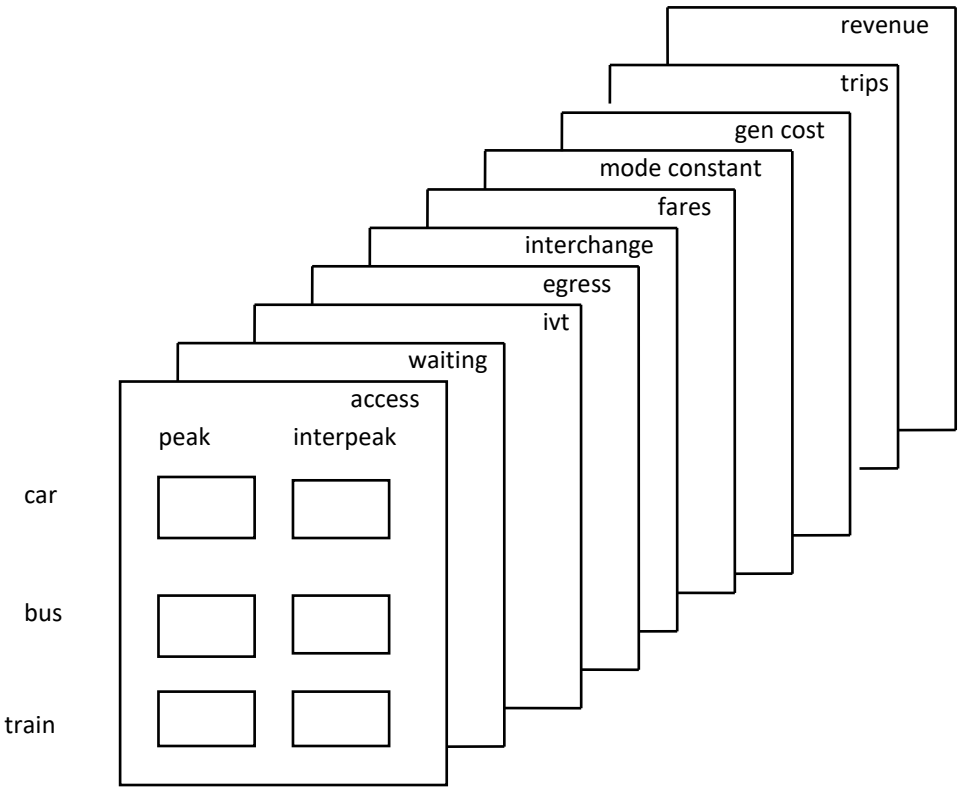


Figure C2. GCOST™ Model Structure

Other outputs, however, are also easily derived. With information already known on both fares, and the number of trips, by Origin:Destination pair, revenue can also readily be calculated. With the number of trips and total time known, time savings between options are also easily derived – and this can form the basis of a preliminary Cost:Benefit Analysis (for Government grants).

St Albans City & District Council

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated Completion Date	Comments / Barrier to implementation
1	Investigate the status of on-street parking in the AQMA and determine if parking is contributing to traffic congestion at each junction. Investigate the provision of on-street loading facilities and co-ordinated timings of deliveries.	Traffic Management	Other	SADC/HCC	2017/18	2019	Parking restrictions in place	See note 1 at end of table	The Parking Team have been consulting on proposals to amend parking restrictions to improve traffic flows during 2019/20. Work on Belmont Hill has commenced. Loading restrictions are in place during peak traffic hours near the shops and these will continue to be enforced. This measure is within the ongoing work programme for new Traffic Regulation Orders being looked at annually.	2019/20	
2	SADC will assert comprehensive control over Part B/Part A2 processes for smaller scale industries under the environmental permitting (England & Wales) regulations 2007.	Environmental Permits	Other	SADC	NA	Annually	Number of inspection	See note 1 at end of table	All processes are risk rated annually and inspection frequency determined based upon risk. Programmed annual inspections to April 2018, are currently up to date. Processes operating without a permit are identified and appropriate enforcement action taken.	Continuous	
3	SADC will investigate complaints about nuisance (domestic and industrial emissions).	Public Information	Other	SADC	NA	On receipt	Time taken to resolve complaints	See note 1 at end of table	Complaints are investigated as and when received.	Continuous	
4	Continue to monitor air quality within the district and as necessary review the suitability of monitoring locations in line with DEFRA guidance TG16	Policy Guidance and Development Control	Other	SADC	2018	Continuous - Reviewed July 2018	Data capture	N/A	The details of diffusion tubes and continuous monitoring are recorded on http://www.stalbans.gov.uk/environmentandwaste/pollution/air-pollution/	Continuous	
5	To increase bus patronage and encourage modal shift from the car to public transport.	Transport Planning and Infrastructure	Bus route improvements	SADC/HCC		2017-19	Service numbers	See note 1 at end of table	St Albans Bus Users Forum provides a platform for bus users, bus service operators and HCC Passenger Transport Team to discuss services and hear about service improvements	Ongoing Meets twice yearly.	

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6	To investigate the feasibility of a Clean Air Zone	Promoting Low Emission Transport	Low Emission Zone (LEZ)	SADC / HCC	2018	NA	Vehicle counts	N/A	To investigate suitability and eligibility for funding for Clean Air Zones via DEFRA		An Air Quality Update report was considered at the CESSC meeting held on 6th September 2018. At this point DEFRA had not released their eligibility criteria, but advised that they would in October 2018. St Albans were eligible to apply and submitted a bid on 30th November 2018. Grant awards ought to be released by March 2019.
7	Pilot the Station Travel Plan.	Promoting Travel Alternatives	Other	HCC	2010		Usage figures	See note 1 at end of table	Station Travel Plan – the travel plan documents are very limited in scope and it will require a Station Travel Plan working group to be established to take ownership of the plan and move towards achieving the objectives. It has been decided to wait until the station development is completed before setting up the working group.		
8	Community Rail Partnership (CRP) The Abbey Line.	Promoting Travel Alternatives	Promote use of rail and inland waterways	SADC/HCC	2010	2011-2016	Usage figures	See note 1 at end of table	Community Rail Partnership (The Abbey Line) – the shuttle bus was found not to be commercially viable so has been withdrawn. The CRP is working closely with the new operator LNR to find ways to engage with communities along the line. This includes a campaign to recruit more station adopters and a primary school engagement programme.		
9	Investigate possibility of road signs to discourage through traffic.	Traffic Management	Other	HCC	2017/18	2018/19	Traffic counts	See note 1 at end of table	Variable Message Signs to be activated during city centre events to inform motorists of delays and parking options.	Continuous	
10	Investigate introduction of additional electric charging at council car parks within the District .	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	SADC	2019/20	2021/22	Usage figures	See note 1 at end of table	Further work on this measure is dependent on preferred service provision options arising from work on the procurement of the car parking contracts. Existing EV charge points in the District are owned and maintained by HCC. HCC is developing a strategy and guidance, together with a Framework to support local Councils proposing to extend existing capacity.	Continuous	

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11	Consider requiring developers to install electric charging points in new developments under S106 agreements.	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	SADC	2018/19	Following implementation of SLP and subject to discussions with Planning Dept. for inclusion in the detailed Local Plan	Installation figures	See note 1 at end of table	We provided a response to the SLP consultation. Further discussions with the Planning Department regarding formulation of St Albans AQ Planning Policy Guidance to provide consistency of advice to developers across Herts & Beds are continuing. Electric Vehicle Charge Points to be installed in new Harpenden Sports and Leisure Centre	2019/20	
12	Consider an increase in car parking charges with the view to making bus travel a more attractive alternative.	Promoting Travel Alternatives	Other	SADC`	2018/19	2019/20	Car park volume figures	See note 1 at end of table	Annual review undertaken. Potential price increase in car park charging is under negotiation.	Continuous	
13	Continue the Trees Against Pollution project and explore green wall/hedging opportunities	Transport Planning and Infrastructure	Other	SADC	2017/18	2018/19	Number of trees planted: 600,000	See note 1 at end of table	Heartwood Forest – this is a new mixed native woodland on private land owned by the Woodland Trust to the north of Sandridge village. The planting of 600,000 trees (mainly as whips or forestry transplants) on approximately 370 hectares commenced in 2009 and was completed in 2017/18, planted entirely by volunteers. Woodland planting has been negotiated on BRE and Harperbury and we are in negotiation on the current Hanstead Wood Application. SADC have an annual programme of tree planting within parks and open spaces (currently £6Kpa). In addition, a special tree planting project was set up to run 2016-2019, value £25K.	Continuous	

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14	Cycling and walking strategy	Promoting Travel Alternatives	Promotion of cycling	SADC / HCC	2016/17	2018/19	Usage figures	See note 1 at end of table	Cycling (2008) and Walking (2009) strategies in place. SADC Green Travel Plan sets out a range of actions to reduce emissions from staff travel. Staff cycle scheme to be relaunched in Spring 2019. Improvements and investments in cycling and walking infrastructure include; • Implementation of the St Albans Green Ring route project. • Production of revised St Albans Cycling map to be launched Spring 2019. • Construction of cycle and walking paths in Verulamium Park. • Provision of secure cycle parking racks within the city centre and at rail stations. • Upgrading and resurfacing of the Alban Way Leisure path. • Installation of Trixie mirrors at key junctions within the city centre • Installation of new section of shared footpath/cyclepath London Road, St Albans . Early cycle release traffic signals at Hatfield Road, St Albans • Improved access to Nickey Line in Harpenden. • New link from Alban Way to St Albans City Rail station. • Provision of way finding monoliths within the city centre.	Continuous	
15	Taxi emissions.	Promoting Low Emission Transport	Taxi Licensing conditions	SADC	2017/18	2018/19	Certificate of Compliance data	See note 1 at end of table	Emissions controlled through Certificate of Compliance at garage check. The frequency of checks is dependent upon the age of the vehicles; 1 – 5 years old; annually 5 – 7 years old; every 6 months Over 7 years old; every 4 months Vehicle Licence Conditions amended to include the following; Any taxi driver can licence a fully electric vehicle as long as it complies with the hackney carriage and private hire vehicle licence conditions. This type of vehicle attracts a discount of £60 The Licensing and Regulatory committee have commissioned a feasibility study into the infrastructure/technological and financial implications of supporting electric taxis across the district. A draft action plan from the feasibility study task and finish group is a Licensing and Regulatory committee agenda item for its January 2019 meeting following the submittal of the grant.	Continuous	

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16	Campaign to raise awareness of air quality and the impact on air quality, of idling engines (when parked)	Public Information	Via the Internet	SADC	2016/17	2018/19	Media coverage	See note 1 at end of table	The Anti-idling campaign was run during 2017 and 2018. This raised awareness of the issue and urged car, van, lorry, bus and taxi drivers to switch off their engine when parked or stationary for more than a minute. It included social media activities, letters, school engagement activities, market stalls, Idling Action St Albans events and information leaflets issued with resident car parking permits. The following numbers were spoken to as part of the campaign: School engagement total 1,700; Community engagement 696 In 2019 we are looking at the possibility of installing street signage to encourage drivers outside schools to turn off their engines when stationary.	2019	
17	Retrofitting of existing bus fleet to lower pollutant emissions	Promoting Low Emission Transport	Other	SADC/HCC		N/A	Number of buses retrofitted	See note 1 at end of table	St Albans were part of a Herts & Beds bid application to DEFRA to work with Arriva Southern Counties to retrofit all pre-Euro 6 buses operating on the bus routes running through the Hertfordshire AQMAs. Arriva Southern Counties operate bus routes through AQMAs within five Local Authority Areas within Hertfordshire: Dacorum Borough Council, East Hertfordshire District Council, North Hertfordshire District Council, St Albans City and District Council and Watford Borough Council. The bid was to retrofit approx. 90 buses costing approx. £1.4 million. Funding was not awarded.	Complete	
18	Freight Management Plan	Freight and Delivery Management	Other	SADC	2014/17	2018	Numbers of vehicles and routes taken	TBC	Project is on hold pending possibility of feeding into larger scale project (feasibility of CAZ) subject to funding stream being available. Outcome of bid application due by March 19.	Ongoing	
NOTE 1 - It is not possible to specifically quantify the impact of small scale projects that the Council are working on with partners. However individual & cumulative AQ measures which reduce emissions are beneficial to improving pollutant levels both AQMA's and the District generally.											