

STARS Phase 2 Report: Estimating cycle potential to Bedfordshire rail stations

Robin Lovelace and Joey Talbot

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1 Introduction

Benefits of cycling and reasons to increase it...

Combining rail travel with cycling is one of the most flexible ways to get around, opening up destinations that might not otherwise be reachable without using a private motor vehicle. Rail stations represent a major destination for cycle journeys, and travel by rail has almost doubled in the last 20 years (ORR 2019). As such, it is vital to understand the dynamics of cycle-rail integration. We investigate this for commuter journeys originating in Bedfordshire.

The Propensity to Cycle Tool (Lovelace et al. 2017) uses 2011 Census data to investigate the proportion of commuters that currently cycle to work, alongside a range of scenarios investigating how cycling levels could

increase. These scenarios include two different approaches to meeting the Government target of doubling cycle commutes. Additionally, the ‘Gender Equality’ scenario models what would happen if women cycled as much as men currently do, since this is the norm in high-cycling countries. The ‘Go Dutch’ scenario models what would happen if cycling in the UK was at the same levels as found in the Netherlands, while accounting for the impact of hilliness and journey distance. The ‘Ebikes’ scenario expands this by assuming widespread adoption of ebikes for longer distance commutes.

However, the treatment of commuter journeys in all of these scenarios suffers from a vital limitation. The 2011 Census provides a comprehensive dataset of journey origins and destinations, but the Census questions relating to commuter travel only record the main mode of transport to work, defined as the mode used for the longest portion of the journey according to distance. Therefore, multimodal journeys are not represented. This is particularly problematic when it comes to journeys involving public transport.

In reality, almost all journeys involving public transport will necessarily be multimodal journeys (Figure 1). The passenger must first reach the train station, bus or tram stop, perhaps doing so on foot, on cycle, or by car or taxi. Following a journey on one or more forms of public transport, they will again require a further trip stage to reach their final destination.

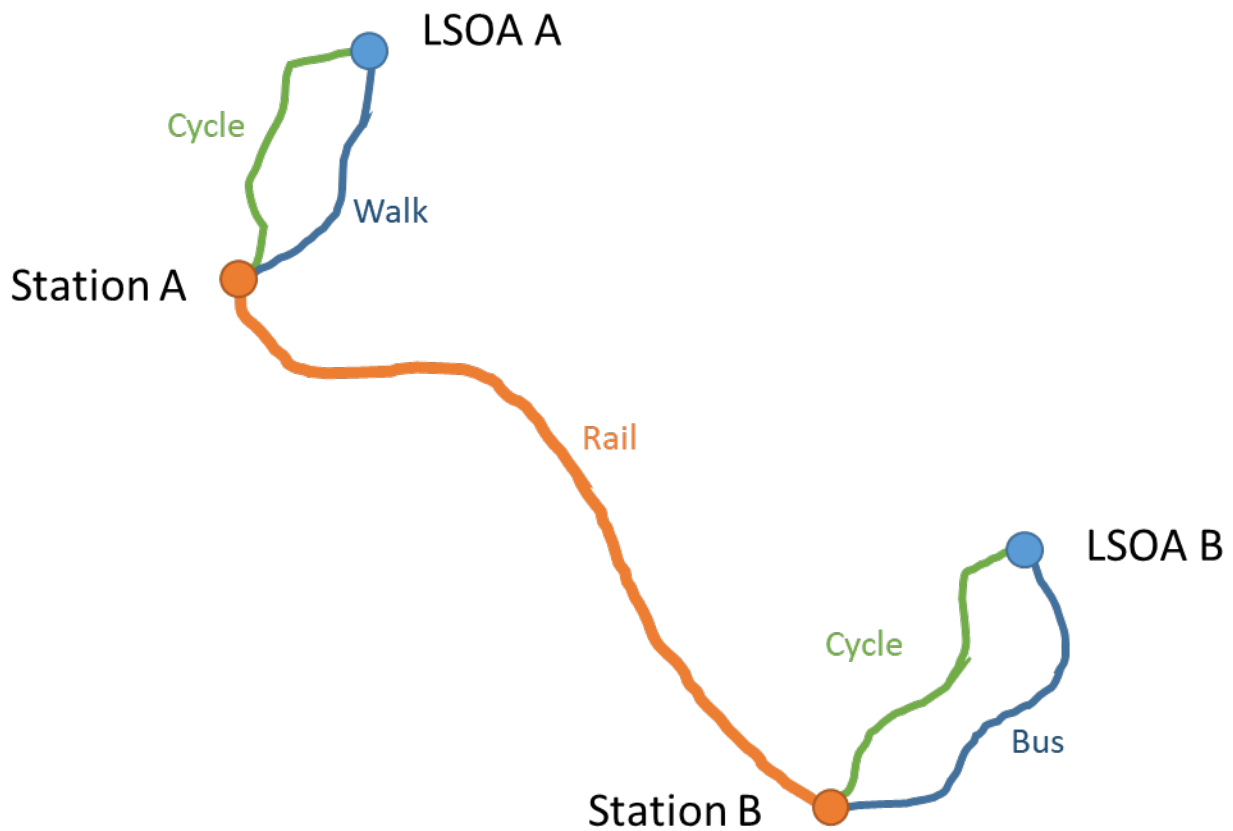


Figure 1: An example showing the multimodal nature of most rail journeys

In counties such as Bedfordshire, commuting by rail is widespread, with the great majority of these commuters travelling to work in London (Figure 2). There are therefore a large number of people travelling to and from local rail stations, who could potentially be accessing these stations by bicycle. These cycle journeys are currently being missed from our estimates of cycle propensity.

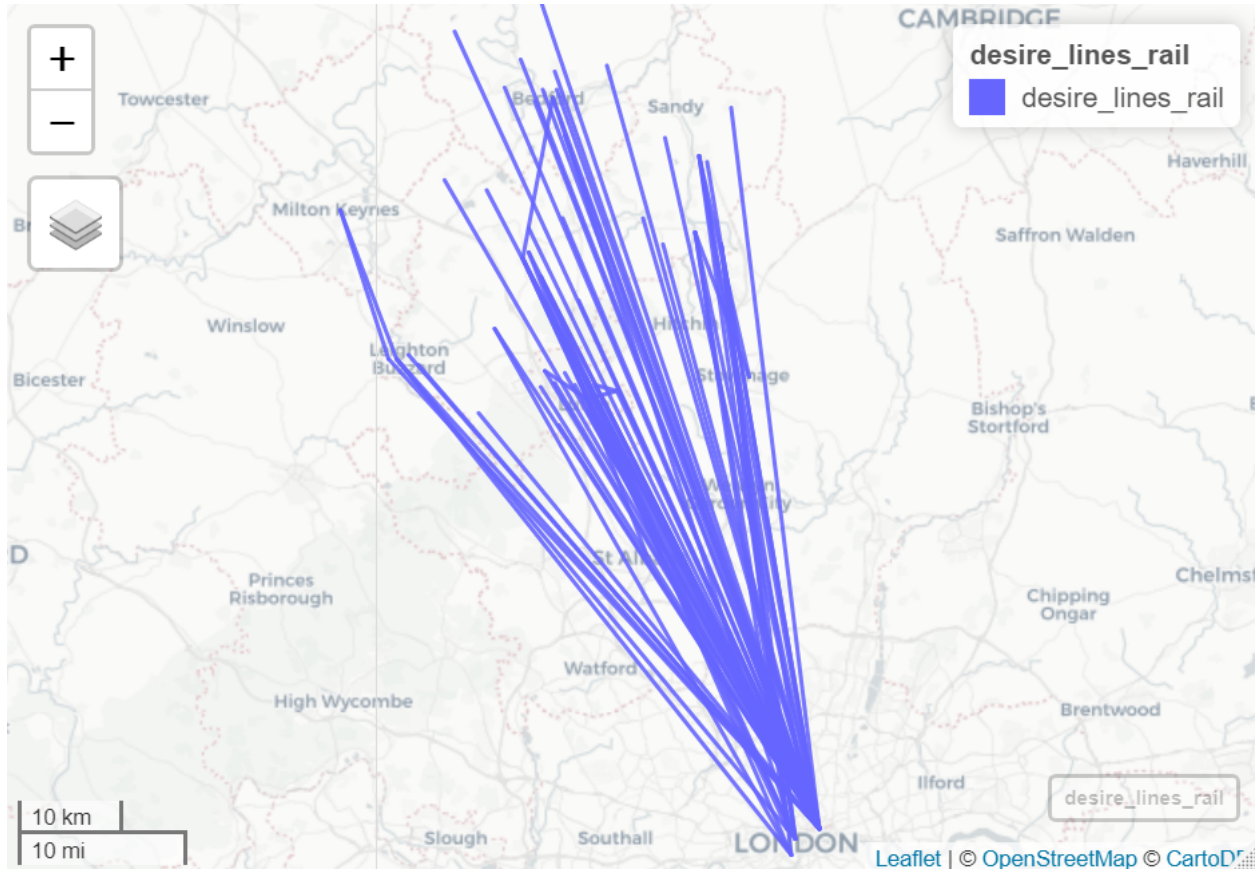


Figure 2: Desire lines for MSOA commute data showing all journeys starting in Bedfordshire where at least 20 people travel by rail

Including journeys to rail stations in the assessment of cycle potential gives a more complete picture of where people want to cycle. This will aid cycle infrastructure planning and the choice of where to focus investment.

1.1 Aims

The aims of this project are to:

- Establish the potential for cycling to stations in the STARS study area
- Inform investment decisions regarding cycle infrastructure and cycle parking at stations
- Feed into monitoring and evaluation of cycling levels

1.2 Modal split of commuting

A high proportion of Bedfordshire commuters currently drive to work. Yet we can see that there is significant potential for cycle commuting to increase. Table 1 shows that the percentage who cycle to work in Bedfordshire currently stands at between 1-4%. If residents were to reach Dutch levels of cycling, this would jump to 14-25%. However, this still ignores the possibility of combined cycle and rail commuting. If we also consider the cycle-to-rail potential, the proportion of cyclists could rise even higher.

lad_name	Commuters	% drive	% rail	% cycle	% active	% Go Dutch
Central Bedfordshire	117753	74	7	2	10	14
Luton	83350	59	7	1	15	20
Bedford	68205	67	5	4	15	25

When we look at individual station catchments, the picture is similar. Again, even when we ignore the potential for combining rail and cycle, the cycle mode share in each catchment could rise substantially, from a 10% rise at Flitwick to a 21% rise at Bedford Midland.

nearest_station	Commuters	% drive	% rail	% cycle	% active	% Go Dutch
Bedford Midland	66203	67	5	4	15	25
Leagrave	64661	68	5	2	12	20
Luton	37973	55	7	1	17	18
Leighton Buzzard	21511	71	9	2	12	14
Flitwick	21109	76	9	1	8	11
Arlesey	17960	76	7	2	9	13
Biggleswade	11770	73	8	3	11	16
Sandy	11202	76	7	2	9	14
Luton Airport	10279	63	6	1	15	15
Harlington	6640	79	8	1	6	10

1.3 Intra-region travel

Around half of all commutes in Bedfordshire take place entirely within the county. When looking at these journeys, we can see that the majority of them are to the nearest town centre, although there is also some inter-town travel. A high proportion of the shorter journeys are made by active travel. These journeys are likely to be similar in distance to many journeys to rail stations. This suggests that many journeys to rail stations could also be made by bicycle if the right infrastructure and facilities supporting cycling are in place.

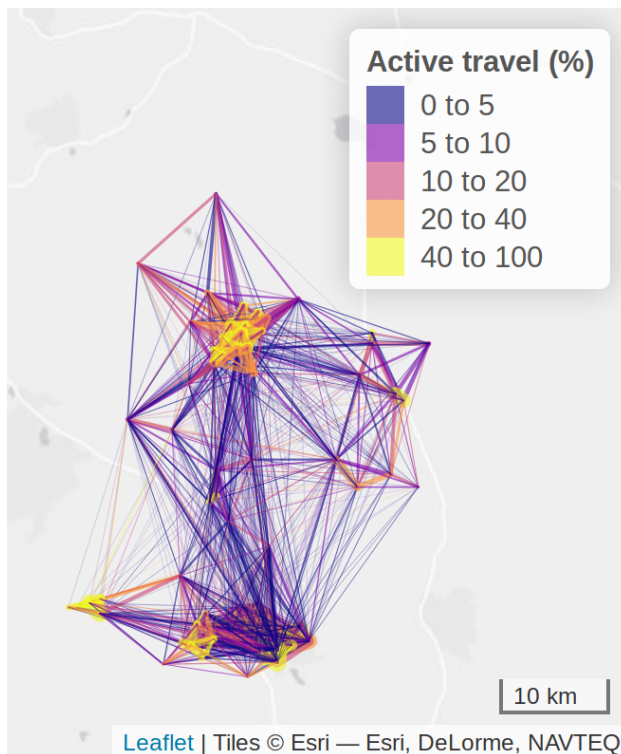


Figure 3: The proportion of commuter journeys within Bedfordshire that are made using active travel

2 Methodology

We have developed two different methods for estimating cycle to rail stations. Both approaches follow these steps:

- 1) Use 2011 Census data to find journeys to work that are made by rail in Bedfordshire. In the 2011 census, the main journey mode is recorded, but secondary modes are not. . . .
- 2) Using our Phase 1 or Phase 2 approach, identify which outbound rail station the journey is likely to use, and map the route from home to this station using the Cyclestreets API.
- 3) Having identified the expected routes to the station for qualifying Bedfordshire commuter journeys, the final step is to estimate the potential for the journey from home to the station to be cycled.

Our approach is focused on commuting. This means we are only considering the cycle-to-station potential for commuter journeys. People also travel by rail for various other purposes, such as leisure, business trips, education, and other personal business. (add in some stats from the ORR) Therefore our estimates do not capture the full potential for cycle to rail stations.

2.1 Phase 1 and Phase 2 approaches for journey routing

Both of our methods make use of 2011 Census data on travel to work. In reality the starting point we use for these journeys is not the commuter’s home. Census data is anonymised and spatially aggregated at the LSOA (Lower Layer Super Output Area) level, a geographic unit with a population of around 1500. For each LSOA it is possible to calculate a ‘centroid’ marking the centre of gravity of the population of the LSOA. Thus, with the identities of the LSOAs each commuter lives and works in, we can use the LSOA centroids as the points of origin and destination for each journey.

In our Phase 1 approach we take the 2011 Census returns and assess them using the journey planning service TransportAPI, to find out whether the trip could be made by rail to arrive by 9:00 AM. If so, we select the fastest rail journey. This method does not simply route commuters to their nearest station, but takes account of their final destination to pick an appropriate station.

The Phase 2 approach starts with commutes originating in Bedfordshire, which are already made by rail according to the 2011 Census. We filter these to select only the trips where there is a rail station within 5 km of the centroid of the LSOA in which the journey originates. Taking the mainline Bedfordshire stations as our dataset, we find the nearest station by road, and route the trip to that station. This is different from the Phase 1 approach in which the departure station was chosen based on the rail journey time.

In Phase 2 we only use mainline Bedfordshire stations, because these all have frequent direct services to and from London and are all well-used stations, with seven of the ten stations having over 1 million entries and exits in 2016-17. This gives us the ten most-used rail stations in Bedfordshire, as listed in Table 3 below. These comprise six stations on the Midland Mainline, three stations on the East Coast Mainline, and one station on the West Coast Mainline. Since the presence of frequent direct services to the main commuter destination of London is a feature of all of these stations, routing via the nearest station seems appropriate when modelling potential cycle journeys.

When deciding whether to use the Phase 1 or Phase 2 approach to model cycle-to-station potential, a key question is whether, for the area in question, commuters are likely to choose to cycle to a more distant station in order to shave some time off their rail journey. If a study focuses solely on relatively large stations with frequent services to the key destinations of interest, the Phase 2 approach is likely to provide the most realistic cycle routings. However, if the aim is to also investigate travel to minor stations which may not have direct services to some important destinations (such as the stations on the Marston Vale line), the Phase 1 approach is likely to be best.

2.2 Modelling all rail commutes

The first step is to identify commuter journeys currently made by rail. @ref/combi6 shows all rail commutes originating in Bedfordshire, as estimated according to our Phase 1 and Phase 2 approaches. The two panels differ because the Phase 1 method routes trips to the station that provides the shortest rail journey time. This can include stations outside Bedfordshire, and the approach also models trips to Bedfordshire stations that originate outside the county. In Phase 2 trips are routed to the nearest Bedfordshire mainline station. We only include trips that originate within Bedfordshire and can be routed to one of the ten mainline Bedfordshire stations.

A further difference is that in Phase 2, we only consider journeys where the distance to the station is $< 5\text{km}$. While this will capture the majority of cycleable trips, it would also be possible to increase this maximum distance to include longer journeys.

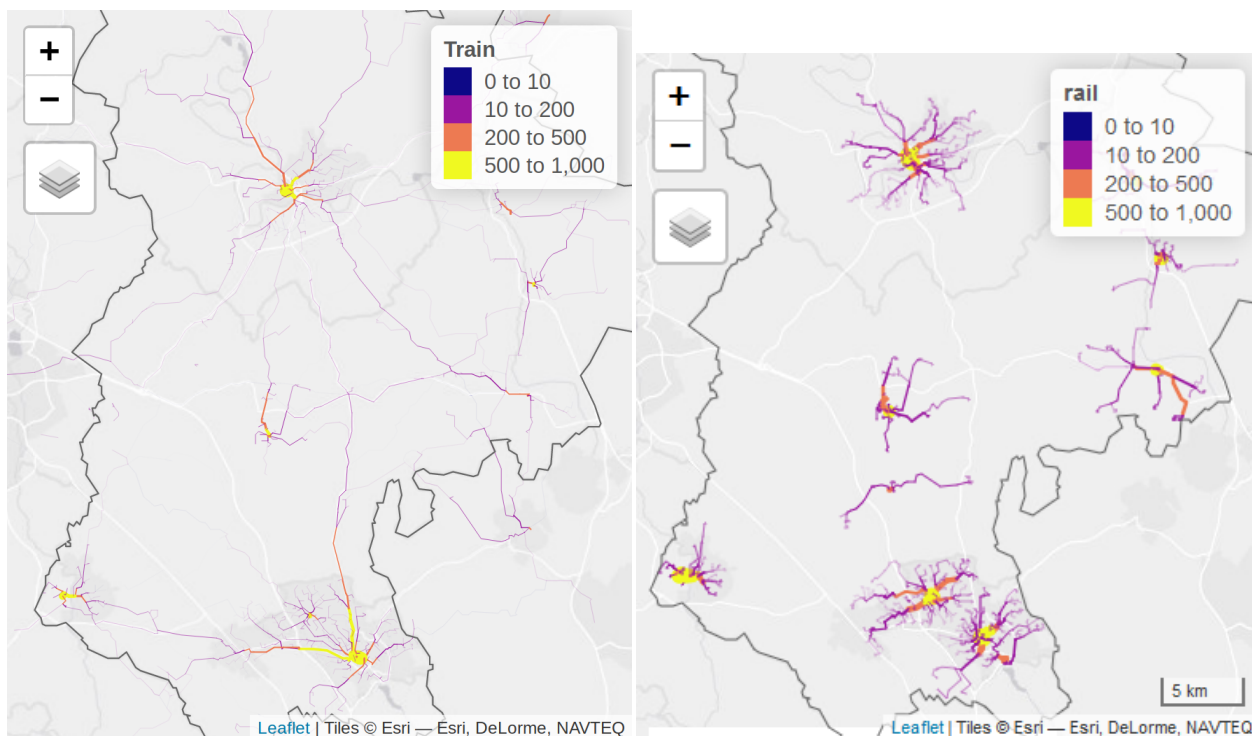


Figure 4: Phase 1 and 2 estimates of cycle to rail potential

2.3 Go Dutch cycle to rail stations (Phase 1 and 2 estimates)

We can now estimate how many commuters would cycle to the station, if cycling levels in Bedfordshire were equivalent to those in the Netherlands. To do this we use the Go Dutch scenario developed as part of the Propensity to Cycle Tool (ref).

We can see some notable differences between the modelled distributions of cycling to stations under Phase 1 and Phase 2. In particular, Phase 2 shows many more cycle trips to Leagrave station. Most of these were routed to Luton station in the Phase 1 method, but since Leagrave has a good quality rail service to London, with trains running every 15 minutes, it may be reasonable to assume that commuters who cycle to the station would be more likely to use Leagrave if it is their nearest station.

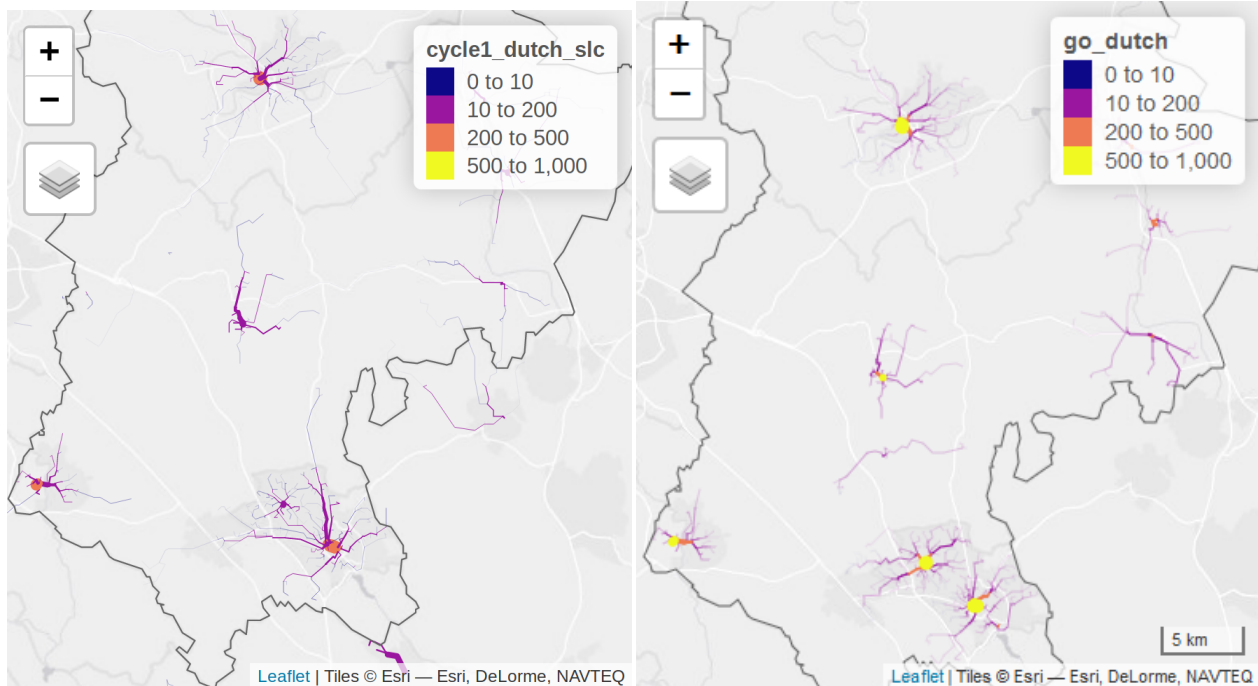


Figure 5: Cycle commuting to rail stations under the Phase 1 and Phase 2 approaches

3 Applications for infrastructure planning

This analysis can help to identify places where it would be particularly useful to install new or improved cycle infrastructure, or to increase cycle parking.

3.1 Cycle route improvements

Our analyses map cycle journeys onto the road network based on the route distance and hilliness. The routes we depict may not necessarily be the ones that are most used by local cyclists. For example, we may route cycle journeys along a major trunk road that in reality is not used by cyclists due to safety fears. Therefore, these results must be interpreted together with knowledge of the local context. There may be alternative routes that local knowledge suggests are more appropriate ways to reach the same destination. However, there are also direct benefits of using this approach. We can reveal roads that are rarely cycled today but could be heavily used by cyclists in future, once improvements are put in place to make cycling there safer or more attractive.

Suggestions based on our Phase 1 analysis have already been discussed in the Phase 1 report. There is a high degree of convergence between the routes selected in the Phase 1 and Phase 2 analyses. However, two routes stand out which are identified as having high cycle potential in the phase 1 analysis, but do not emerge as major routes in the Phase 2 analysis. These are New Bedford Road north of Luton station, and the cycle path alongside the Luton-Dunstable Busway. The reason these routes do not emerge in the Phase 2 route network map is because the journeys in these areas are routed to Leagrave station rather than Luton station. However, even if residents here do tend to use Leagrave station, cycle access into Luton town centre will still be important for accessing all of the other services the town centre provides, such as employment, retail, leisure and entertainment. As we can see in @ref/combi8, both of these routes both already benefit from some cycle provision, but improvements such as increasing the number of access points

onto the Luton-Dunstable Busway path would be welcome. At the moment, the limited number of access points is likely to restrict usage of this path.

3.1.1 Phase 2 suggestions - Luton

In Luton, we can see that the existing cycle infrastructure is relatively limited, with cycle lanes or tracks only present on a small number of routes from Luton or Leagrave stations.

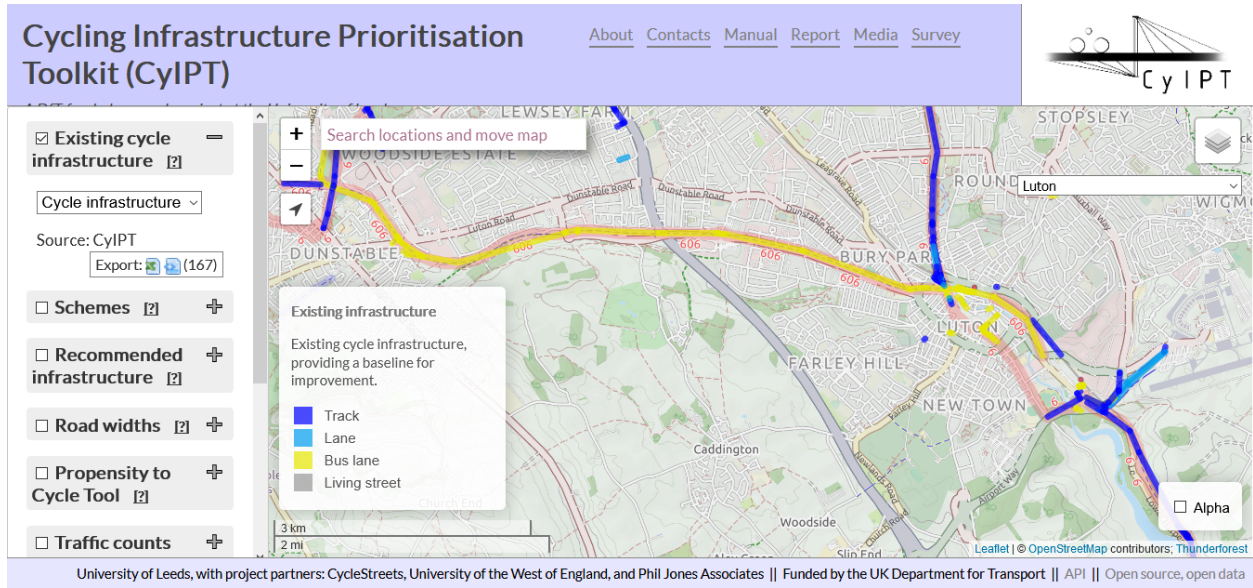


Figure 6: Existing cycle infrastructure in central Luton, as recorded by CyIPT

However, there is a strong overlap between the roads we find high to have cycle potential under the Go Dutch Phase 2 scenario, and routes that have already been proposed as candidates for new cycle routes in Luton. These include:

- a route heading west from Leagrave station along Compton Avenue and Leagrave High Street;
- a route north from Leagrave station along Toddington Road, linking the station to the Luton to Dunstable and Sewell Greenway;
- and a route north from Luton station that is broadly parallel to High Town Road.

Other routes that appear to be candidates for cycle improvements according to the Phase 2 analysis include:

- Old Bedford Road in Luton;
- Bramingham Road east of Leagrave station;
- and connections from Luton station southwards to Farley Hill.

3.1.2 Phase 2 suggestions - Bedford

In Bedford the cycle provision is more heavily developed, as we can see in Fig x. However, there is a lack of cycle infrastructure in the immediate vicinity of Bedford Midland station. Add in maps?

Our analyses call for cycle improvements in three main directions from Bedford station:

- southwards along the A5141 to allow cyclists to cross the River Great Ouse on Prebend Street. This allows access to the station from Bedford's southern suburbs;
- northwards on the A5141 (including a link across the railway line on Bromham Road) to link into the existing cycle provision on Bromham Road and Clapham Road. This allows connections to the villages of Bromham, Biddenham and Clapham;
- and eastwards to reach the station from the eastern and northern suburbs of Bedford. The two key routes that emerge here are the A4280 across Bedford town centre, and a more northerly route that follows Union Street, Roff Avenue and Park Avenue.

3.1.3 Phase 2 suggestions - Central Bedfordshire

Within Central Bedfordshire, routes that appear to be candidates for cycle improvements according to the Phase 2 analysis include:

- Leighton Road, crossing the River Ousel between Leighton Buzzard station and the town centre;
- Flitwick Road / Ampthill Road between Ampthill and Flitwick;
- and routes from Arlesey station to nearby towns and villages such as Stotfold and Henlow.

Add in detailed PCT and county maps?

3.2 Cycle provision at rail stations

In addition to the routes to stations, it is important to consider cycle provision at the stations themselves. The need for improvements such as additional cycle parking stands can be assessed using this tool. There may be an overall need for more cycle stands at a given station, or there may be a need for more stands at a specific station entrance to cater for journeys coming from a particular direction.

Table showing number of journeys to each station in Phase 1 and Phase 2, and the number of cycle racks at each station (National Rail data).

Our Phase 1 model shows xx journeys to Luton station, suggesting a need for more cycle stands as cycling uptake increases. Meanwhile, our Phase 2 model shows xx journeys to Leagrave, of which xx follow x Road to reach the station from the east. There may be a need for more cycle stands on this side of the station.

A range of other station improvements may also be considered. These could include more secure cycle parking facilities such as lockable bike bins, or staffed 'cycle hubs' that could also offer additional services such as repairs and sales. Cycle hire facilities would cater for those travelling to Bedfordshire stations from elsewhere. If feasible, working with Train Operating Companies to improve cycle carriage on board trains could enable many further journey options, with the flexibility gained by cycling at both ends of the rail journey. In relation to this, the installation of lifts to allow level access to platforms may also be considered.

3.3 Monitoring and evaluation of cycling levels

A programme of monitoring and evaluation of cycling levels is vital for the assessment of progress in raising cycle-to-station uptake. The goals of monitoring will include establishing a baseline estimate of cycling levels across the county, and assessing changes from this baseline. Monitoring can be used to evaluate the impact of interventions, to provide a before-and-after picture revealing how new cycle infrastructure changes travel behaviour.

The scenarios found in this report can assist a monitoring programme in terms of guiding the locations of monitoring sites (at stations or on-road), and guiding expectations for increased cycling uptake at these sites. Conversely, survey results can also be fed back to suggest whether our Phase 1 or Phase 2 approach appears to better model cycling patterns in a given area, or whether changes may be needed to these models.

4 Limitations and scope for further research

There are various ways in which these models could be changed or improved.

In this report, each Bedfordshire station is represented by a single point, located at the main station entrance. However, many stations have multiple entrances giving access from two or more different streets. If these other entrances are also accessible by bicycle, this opens up potential for cycle routes to the station that are not currently being modelled. We expect the impact of this on suburban routings to be relatively limited, but it could have greater impact on our town centre cycle routings. For example, Luton station has a second entrance on Midland Road. If this entrance was included, we could expect that many of the cycle journeys which our Phase 2 analysis shows as passing along North Street and Old Bedford Road would be rerouted to instead follow High Town Road.

Combination of Cyclestreets routing and distance-based criteria can produce counter-intuitive results...

Currently, the assessment of hilliness uses the average gradient across the full journey distance. Use of maximum gradient may be more appropriate, since this better reflects the limiting factor for many cyclists.

5 References

ORR (2019), ‘2019-20 Q1 Statistical Release – Passenger Rail Usage | ORR Data Portal’. Accessed 12 November 2019. <https://dataportal.orr.gov.uk/statistics/usage/passenger-rail-usage/>.