Milton Keynes Council

MK2050 Growth Study

Mobility and Mass Rapid Transit Study

March 2019

Mobility and Mass Rapid Transit Study

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Produced by:

For:

Milton Keynes Council

Contact:

Geoff Burrage

Integrated Transport Planning Ltd.
6 Hay's Lane
London SE1 2HB
UNITED KINGDOM

0203 300 1810
burrage@itpworld.net
www.itpworld.net

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Project Director	Neil Taylor
Project Manager	Geoff Burrage
Quality Manager	Neil Taylor
Additional Team Members	Matt Cottam, Jake Collett
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Executive Summary

Context

Milton Keynes is recognised as one of the UK's most successful 'new towns'. It has a unique character, a strong economy and is loved by its residents. Built at low gross density with extensive green spaces, the city was designed with the intention of delivering equality of access for public and private transport. However, in practice the original form of the city is not well structured for public transport operation while allowing for quick access by car from any point, to any point, in the city.

In practice the convenience and short journey times possible by car, combined with the difficulty of operating high-quality public transport within the city, has meant that the car is the dominant mode of transport, with 72% of journeys to work by car and only 6% by bus and 3% by bike. Public transport is predominantly used by those who do not have a choice.

Several significant implications arise from these car-centric patterns of travel that were unforeseeable when the city was first being planned. Public health is impacted, with high levels of obesity and average life expectancy below the national average. Levels of deprivation are increasing relative to the rest of the UK, and those areas with the highest levels of deprivation tend to have the lowest levels of car ownership, which means they are least able to benefit from the opportunities available within the city. Furthermore, per capita CO_2 emissions in Milton Keynes are in the top 10 cities in the UK due to the high levels of car use, despite the relatively modern housing stock and infrastructure.

Milton Keynes is already one of the fastest growing cities in the UK. The growth study this report informs seeks to inform delivery of Milton Keynes Council's aspiration to grow the city from 260,000 residents today, to 500,000 by 2050. Even without any plan in place, it is anticipated that the population will grow to around 436,000 in that time. Transport modelling undertaken in support of Plan:MK demonstrates that by 2031 the pressure from around 30,000 additional homes and increasing employment space, will result in 14% longer journey times and an increasing number of road links and junctions over capacity, even with investment in the highway network. Looking forward to 2050, and the very substantial additional growth in movement associated with an additional 70,000 people, journey times and traffic congestion are expected to worsen significantly in a 'more of the same', private car led mobility scenario.

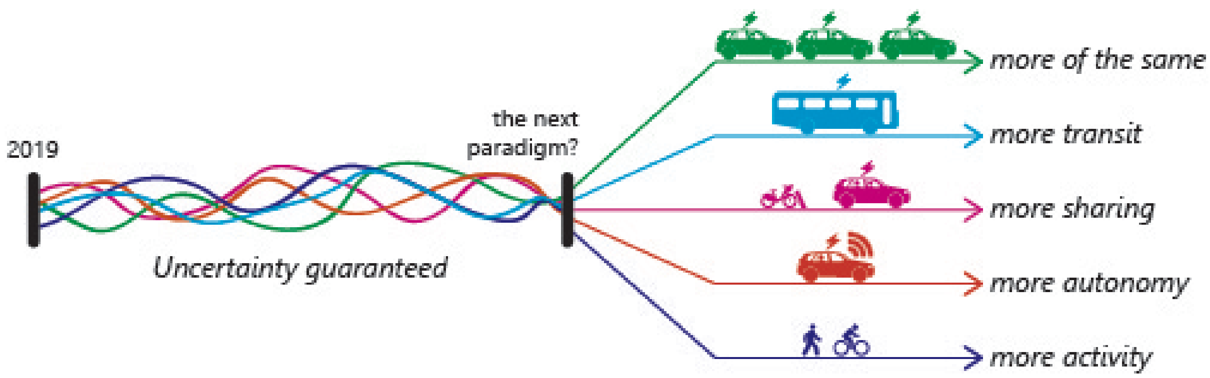
Research over decades has repeatedly demonstrated that building additional highway capacity in isolation does not solve traffic congestion, and ultimately leads to increased traffic levels. Furthermore, even if additional highway capacity could solve the existing and future congestion problems from a car-based mobility strategy, the mobility inequality issues set out above would not be addressed – locking Milton Keynes into the current trend of being a 'two-speed' city and not addressing existing transport inequalities.

The successful growth of Milton Keynes to 2050, and beyond, and delivery of an efficient, 21st Century public transport network therefore appears to be intrinsically linked. 'Business as usual' cannot accommodate the Council's aspirations for growth. Even if there is significant uptake of autonomous vehicles, leading to more shared travel, and greater capacity can be extracted from the existing highway network, the substantial anticipated growth in population and travel demand, necessitates more space-efficient ways of moving people around Milton Keynes.

A change in approach from personal mobility to 'smart, shared, sustainable mobility', is essential. Change takes time and therefore it is vitally important that the right planning and infrastructure decisions begin to be made now, rather than waiting for gridlock to force a change in approach that will be significantly more difficult to achieve. This study has investigated how a Rapid Transit (RT) network might form a core component of a 'smart, shared, sustainable mobility' system for Milton Keynes.

Responding to MK's mobility challenges

Five potential technological scenarios have been considered in order to understand what future mobility trends might look like in Milton Keynes. Depending on which of these come to fruition, and when, a range of possible outcomes are possible; with the only current guarantee being uncertainty.



It is clear that 'more of the same' will not result in transformational or 'good growth' in Milton Keynes, but in more sprawl and congestion and less active travel with associated health impacts. The adoption of technological solutions, particular CAVs ('more autonomy'), will have an important role to play as part of the wider mobility landscape; potentially helping to satisfy a 'first/last mile' demand, dramatically reducing the overall vehicle fleet, growing the public transport catchment and transforming inter-urban travel on smart motorways. On its own, however, more autonomy is unlikely to dramatically shift the status quo away from the car use in MK.

'More activity' would deliver substantial health, congestion, air quality and productivity benefits. It could also help satisfy 'first/last mile' demand by non-motorised means, which are highly compatible futures alongside 'more transit' and 'more sharing'. Taken together, these scenarios would deliver positive outcomes by supporting more efficient use of land and resources though selective densification at key locations. This would ideally be coupled with reduced parking capacity, purposive economic and housing growth along new transit routes as part of a deliberate plan to capitalise on rapidly changing transport technologies and innovations. In combination this could deliver more equitable and inclusive access to new and existing jobs and services by prioritising shared modes of affordable transport. At the core of MK's offer could sit a trunk network of high capacity RT services. The spatial arrangement of development, and the density at which it is delivered must respond to this network and provide the patronage to make it viable. Benefits include:

- **Improved efficiency**, moving more people in less space and responding to the growing demands of a larger population
- **Mobility for all**, allowing the opportunities created by growth to be accessible by all affordably, whether or not they own a car
- **Reliable journey times** into the city centre, by promoting a mode shift away from the car and providing a high degree of segregation from general traffic
- **Healthier places**, increasing opportunities for walking and cycling and by allowing new Transit Oriented Developments to be created and delivering on the principles of the NHS Healthy New Towns programme
- **Improved environment**, protecting and enhancing the quality of Milton Keynes and respecting the original vision
- **21st century city**, delivering a heart for the Cambridge, Milton Keynes, Oxford arc
- **Improved competitiveness**, helping attract and retain talent and reduce congestion
- **Protection of the climate**, responding to climate change by reducing per-capita CO_2
- **Good growth**, by planning spatial growth so as to deliver specific, desired outcomes

RT:MK – a proposed network

A number of key principles have been adopted to inform the design of a RT network for Milton Keynes. They focus on ensuring it will be an attractive and viable mobility option for all, while facilitating 'good growth' of the city.

Table 1: Key RT network principles

Key Principle	Description	Mobility Opportunity Satisfied
Integrated	RT offers flexible, high frequency, high capacity trunk network role, supported by integrated network of shared transport services and high-quality walking and cycling infrastructure	Integration across modes / Inclusive alternative to car / Responding to future changes / Mobility for all
Competitive	RT routes generally follow grid roads, allowing for fast, direct routes with fewer stops in comparison to local buses (every ~850m) enabling journeys that are time and cost comparable with those by car	Inclusive alternative to car / Future proofing journey times / Mobility for all
Reliable	Around 90% of the network is segregated, either in grid roads or new development sites, allowing for reliable journey times, complimented by a high degree of 'queue-jump' priority for RT at junctions	Inclusive alternative to car / Future proofing journey times
Delivering Transit Oriented Development	Facilitates high-quality, higher density development with reduced parking levels and priority for walking and cycling. The street network in new developments will favour RT, walking and cycling options over those by car	Active Places by Design / Supporting High Density Places
Delivering Mobility Hubs	Many RT stops will be mobility hubs, providing access to a range of services such as drop-off for on-demand services, cycle hire and parking, car clubs, click & collect, and convenience retail	Integration Across Modes
Flexible	The RT network must allow for flexible use in future to accommodate changes in technology, as well as potentially allowing shared use of the network at off-peak times, for example for freight delivery, shared vehicles, CAVs etc.	Inclusive Alternative to Car / Future Proofing Journey Times

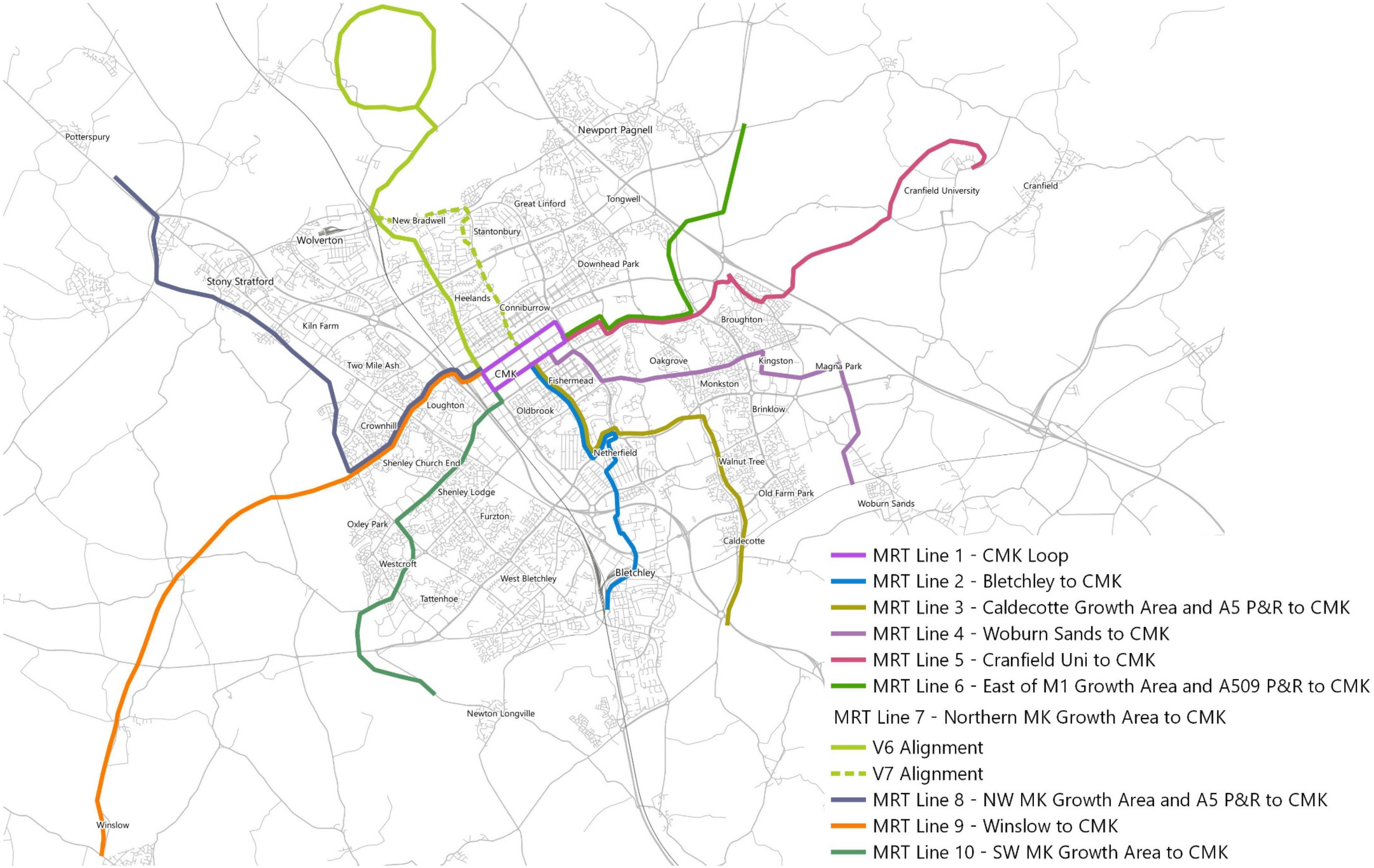
The proposed RT network will connect existing destinations and trip generators, along with new Transit Oriented Developments. Their delivery in spatial locations proposed as part of the growth study both enables, and is enabled by, the RT network. Crucially, these new developments will be designed around RT; embedding enabling infrastructure seamlessly from the outset. The network reaches outside the existing Milton Keynes urban area; connecting possible new communities in neighbouring Districts and offering an opportunity to extend further to growth areas like Cranfield and Ridgmont.

Close collaboration with colleagues at David Lock Associates (DLA), who are leading the overarching MK Growth Study, has ensured the location and form of development is conducive to RT and delivers growth in a way that strengthens demand for proposed routes. RT will ideally sit front and centre of the approach to both placemaking and future mobility planning, thereby guiding optimal locations for growth.

Table 2: Proposed RT route descriptions

Line	Description
Line 1: CMK loop	Serves growing employment and residential demand in CMK
Line 2: Bletchley to CMK	Serves regeneration of CMK and V7 corridor as well as key trip generators as the stadium and hospital
Line 3: Caldecotte Growth Area and A5 P&R to CMK	Serves Plan:MK allocated growth as well as the Open University campus and hospital and potential A5 P&R
Line 4: Woburn Sands to CMK	Serves Plan:MK allocated growth as well as Kingston, Magna Park, a proposed new E-W station and new community
Line 5: Cranfield Uni to CMK	Serves Cranfield Uni and new communities surrounding it, Plan:MK allocations and new communities E of M1 and the existing J14 P&R
Line 6: East of M1 Growth Area and P&R to CMK	Serves Plan:MK allocated growth as well as new communities east of Newport Pagnell and a potential A509 P&R
Line 7: Northern MK Growth Area to CMK	Serves a new community to the north of the city as well as Hanslope Park and potential regeneration sites along V6 and V7
Line 8: NW MK Growth Area and A5 P&R to CMK	Serves Plan:MK allocated growth, a new community to the NW of the city and development along Portway and potential A5 P&R
Line 9: Winslow to CMK	Serves new communities in AVDC from Winslow, including a potential E-W station at Winslow
Line 10: SW MK Growth Area to CMK	Serves Plan:MK allocated growth, new communities around Newton Longville, regeneration at West Croft and a potential A421 P&R

Figure 1: Proposed 2050 RT network



Supporting the core network shown in Figure 1, local mobility services are expected to provide a feeder network that caters for 'first/last mile' demand and areas of the city not connected directly to RT. These underlying services are crucial to the success of the RT network in low density Milton Keynes, significantly extending catchment and therefore access to opportunities. In this way they are also central to achieving 'mobility for all'. Local mobility services will ideally include some or all of the following services, brought together through a Mobility as a Service (MaaS) platform:

- City-wide public bike and eBike hire (with an improved cycle network)
- Local buses
- On-demand taxi, bus and minibus services
- Car Club / flexible car hire services
- Autonomous pods and shuttle vehicles (as technology and legislation allows)

The RT network is expected to have spare (traffic-free) capacity at certain times of the day that can be made available on a flexible basis for alternative uses. These could include permitting low/zero-emission freight vehicles to fulfil online shopping orders and city-centre store servicing, and/or potentially allowing autonomous or other shared mobility services to use the network. Access might either be possible during fixed hours or, making use of increasingly connected vehicles, on a dynamic basis. Modest access charges could generate an additional revenue stream that supplements the financial viability of the RT network. These have not been factored-in to our early revenue forecasts, and the RT system's delivery is not contingent upon any such revenue.

In developing the RT network two high-level options have been considered – rubber tyred vehicles (RTV) and tram. The evidence set out in this report suggests that if a RTV network is built with the same levels of priority as would be expected for a tram network then the outcomes, in terms of mode shift from car trips and user satisfaction, can be comparable. However, the cost of constructing a tram network in Milton Keynes is expected to be around four times that of an equivalent RTV / BRT network (based on precedents from elsewhere). This relates primarily to the additional requirements of track and catenary (or at stop induction charging) infrastructure, and the extensive utility diversions that are typically required when constructing tramways.

Figure 2: High quality RTV operating on the Belfast Glider

Source: Love Belfast

In order to determine infrastructure cost and journey time, each section of route has been classified as one of five design types. For each type of route an anticipated vehicle running speed has been assumed and this, along with stop dwell time, determines an estimate of achievable journey times between key destinations.

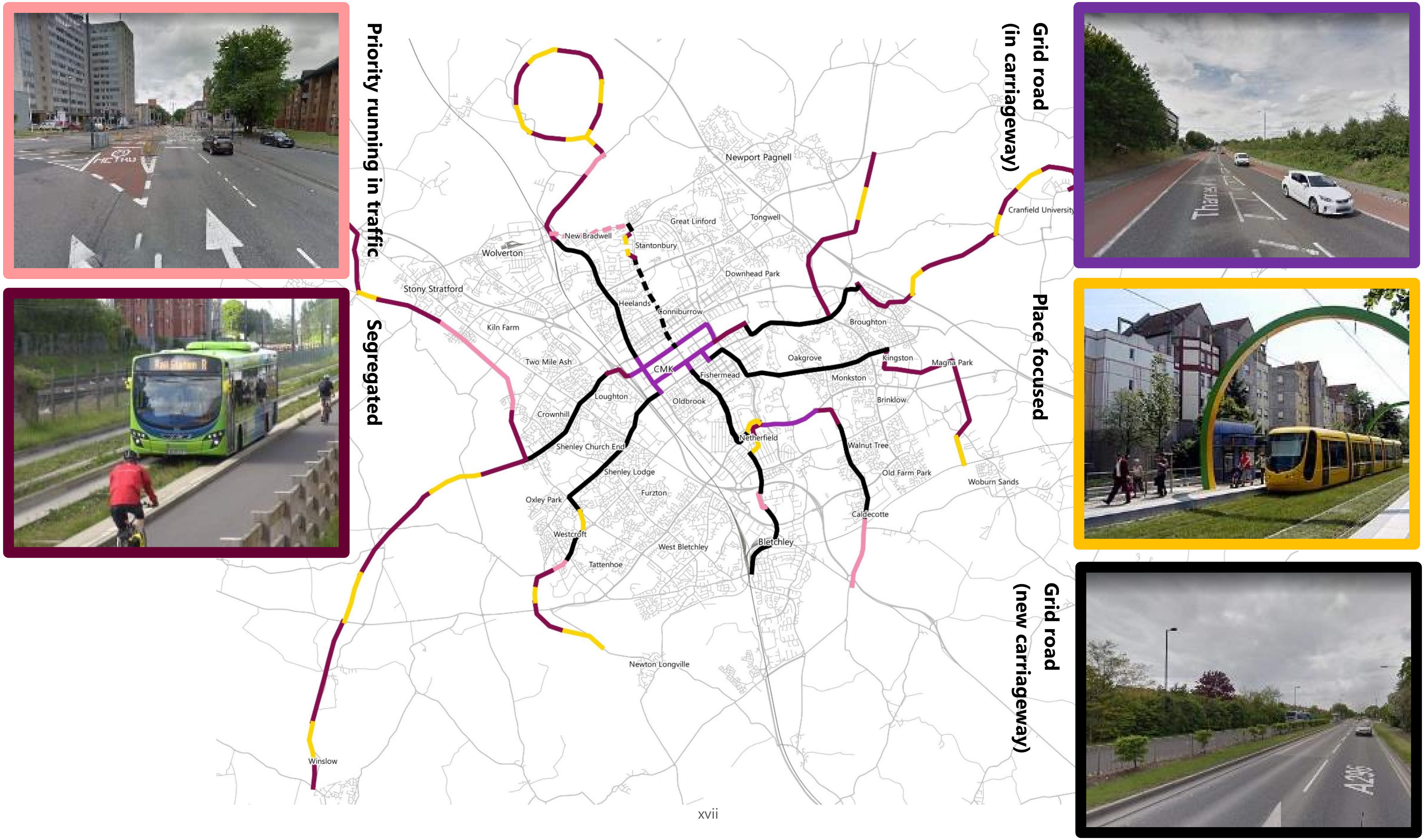
The design types and assumed running speeds and per-km costs are set out in Table 3. The route type, along with precedents, are shown in Figure 2. In total, around 90% of the proposed network is segregated allowing for reliable journey times, which will be crucial as congestion grows to 2050.

Table 3: Route type, including running speed and cost per km

Route type	Description	Running speed	Cost (per km)
Priority running in traffic	RT vehicles run within mixed traffic but with measures such as dedicated lanes and signal priority at junctions	30kph	£1,875,000
Place focused	RT vehicles have a dedicated alignment within a landscaped public realm in new developments	30kph	£7,580,000
Grid road (in carriageway)	RT vehicles run within dedicated lanes adjoining or within the existing carriageway	70kph	£3,750,000
Segregated	RT vehicles have a dedicated alignment between Milton Keynes and adjoining settlements or new growth locations	55kph	£7,580,000
Grid road (new carriageway)	RT vehicles run in dedicated lanes along a new alignment within the existing highway boundary but separate from the existing carriageway	70kph	£7,580,000

As well as providing a high degree of segregation along links, RT must be afforded priority through junctions. As the majority of lines will run for at least part of their route along the existing grid road corridor, a number of existing roundabouts will require retrofitting to provide priority to RT. A range of junction design measures will need to be developed drawing on best practice from the UK and Europe. These will include signal-controlled RT gates, dedicated RT lanes running through the central island (the 'hamburger' approach) and conversion of roundabouts to signalised cross roads. Segregated cycle routes would need to be designed into these schemes.

Figure 2: Route types and precedents



Operational and financial feasibility

To determine the operational characteristics of the RT network and therefore its capital and revenue costs, we made the following core assumptions:

Table 4: Network core assumptions

Assumption	Description
High Frequency Services	Maximum (off-peak) service headway of nine minutes. Along with vehicle carrying capacity, frequency determines the capacity of the line. Capacity must relate to demand to remove need for significant public subsidy.
Route type and Assumed Vehicle Speeds	Five route types have been defined with anticipated vehicle running speed. Applying an assumed running speed to each route type, alongside a stop dwell time of 30 seconds per stop, allows journey times to be estimated.
Capital & Operating Costs and Revenues	High level cost estimates for the proposed RT routes are based on per-km and vehicle costs from RT schemes in the UK and elsewhere. Operating costs are based on TfL's annual bus operating cost per vehicle, with an uplift factor applied for trams. A fare of £2 per journey is assumed.
Future Demand Scenarios	To establish future demand on the RT network we established low (6%), medium (15%) and high (29%) mode share scenarios. The low scenario is based on MK's existing bus mode split, 15% reflects the mode share of Helsinki's BRT light, while our high scenario reflects public transport mode share along Nottingham's established tram corridors.
Park and Ride	Based on the potential park and ride (P&R) sites identified in MKC's Mobility Strategy, alongside analysis of trip distributions into the city based on the MK Multi-Modal Model (MKMMM), five P&R locations have been included within the assessment. These sites are expected to intercept car trips, thereby easing predicted future traffic congestion levels, as well as generating patronage for the RT network.
Growth Beyond 2031	85% of new residential development post 2031 is assumed to be served by RT. This will require higher densities than those which have been traditionally delivered in MK (achievable through Transit Oriented Development). Only residential trips have been assessed.

Forecasts for capital costs, annual demand (across the three demand scenarios), revenue and operating costs were made on the basis of these core assumptions, to derive conclusions on the operational and financial feasibility of the network in 2031 and 2050. The key outputs summarised below are based on the medium demand scenario of achieving a 15% RT mode split.

- The overall capital cost of a RTV network is around £1.1bn, compared to around £4.5bn for a tram network.
- Annual demand across the network is ~5.5m trips by 2031 and ~13.2m trips by 2050.
- Annual RTV operating cost, based on peak vehicle requirement plus 10%, is £13.6m, compared with £22.4m for a tram system.
- Annual revenue, based on forecast demand, would cover 80% of the RTV network operating costs by 2031, but only 49% of a comparable tram network. At this level of cost recovery an RTV the network would require some public subsidy, which may be considered appropriate in the initial stages of operation. Moreover, operating costs may be adjusted by amending service headways to more closely match demand (albeit lessening frequencies) and additional revenue may be generated from other sources ('pump priming' from development secured by planning obligation, advertising and access charges).
- In 2031 Lines 3 and 6 would be the most profitable, reflecting the potential additional demand generated by P&R and the amount of new housing planned in their catchments.
- By 2050 annual revenue would exceed operating costs by 93% for a RTV network and 18% for tram, with revenue exceeding operating costs by over 150% for some lines. In practice profits of this scale would not be realised as service frequencies, and therefore costs, would be expected to increase in order to meet higher passenger demand.
- Those lines close to the most new homes, and which serve a P&R site(s) appear most feasible. The current low-density of Milton Keynes' urban form means development must be phased along RT corridors if it is to successfully build demand along each line.
- Cross-subsidising some lines may be necessary, particularly up to 2031, to deliver a cohesive network. For example, Line 2 from Bletchley is forecast to carry fewer passengers due to the limited amount of new housing along its route compared with other lines. However, there is a strong case for delivering it early as it will provide a catalyst for regeneration, improve the range of travel options in some of MK's regeneration estates and respond to new infrastructure such as East-West Rail and the Expressway.

A basic economic appraisal was undertaken to provide an indication of the likely scale of costs and benefits over the lifetime of the project. The methodology applied to undertake this economic appraisal draws on the latest DfT WebTAG guidance for determining the Value for Money of major transport schemes, but is necessarily high-level owing to the early feasibility scoping nature of this project.

A tram option for the whole network returns BCRs between 0.73 to 1.10 depending on the scenario. This suggests a tram would represent 'poor' to 'low' value for money. A RTV option for the whole network returns BCRs between 2.95 and 4.43 depending on the scenario. This suggests RTV may represent 'high' to 'very high' value for money. The key determinant in both cases was the scale of construction and operation costs (with tram networks being 4-5 times more expensive than RTV options) relative to the potential patronage, and therefore revenues, that could be generated.

We also undertook accessibility mapping to determine the potential impact of the proposed RT network, particularly for the most deprived parts of the borough. The proportion of the current population within the most deprived wards of MK within a 20-minute public transport journey time of the central railway station increases from 24% currently to 39.5% following the introduction of the RT network (an increase in population from 10,503 to 16,959). This demonstrates that the RT network, and particularly the lines serving the most deprived wards, (lines 2, 3, 8, 9 and 10), will make a tangible contribution towards the objective of improving mobility for all.

Phasing and delivery

The viability of the proposed RT routes is driven by the new housing proposed as part of the growth study. The whole network would not be viable in 2031, and there is no way sufficient new housing and employment growth could be delivered to support it. Instead, a phased approach would deliver RT in a way that responds to the travel demand arising from new developments while delivering wider benefits.

The following lines are proposed to be delivered in the first phase of implementation running to 2031:

- Line 1: CMK Loop
- Line 2: Bletchley to CMK
- Line 3: Caldecotte Growth Area and A5 P&R to CMK
- Line 4: Woburn Sands to CMK
- Line 6: East of M1 Growth Area and A509 P&R to CMK

These lines are focused on areas that will deliver housing and employment land that is allocated before 2031 and on early opportunities to drive demand through P&R sites, as well as acting as catalysts for regeneration.

The remaining lines would be better delivered between 2031 and 2050 and include:

- Line 5: Cranfield University to CMK
- Line 7: Northern MK Growth Area to CMK
- Line 8: NW MK Growth Area and A5 P&R to CMK
- Line 9: Winslow to CMK
- Line 10: SW MK Growth Area to CMK

These remaining routes align with the major new Transit Oriented Developments proposed as part of the growth study, and are therefore highly reliant on capturing trips from new housing and employment sites that are unlikely to be delivered before 2031.

Access to the RT network will need to be managed in order to ensure that RT vehicles are given priority. This might require adopting powers available to the existing Local Authorities such as Enhanced Partnerships, although the opportunity might become available to consider routes to securing additional powers if a Development Corporation is created. A range of supporting measures will also be required to ensure the success of a RT network. These include:

- Supporting and managing development of a network of 'first/last mile' modes and encouraging MaaS to develop in a way that is complementary
- Developing a city-wide parking and P&R strategy
- Considering demand management measures such WPL or road user charging
- Adopting a preferred RT route network and safeguarding and securing corridors (both within development and within the highway)
- Reducing car parking levels in new development
- Managing vehicle access and parking, particularly in new developments and the city centre
- Enhancing the walking and cycling network alongside the RT network, and safeguarding land as necessary
- Delivering Transit Oriented Development
- Adopting appropriate planning and transport policy to secure the above
- Prioritising infrastructure that prioritises RT

A range of funding sources will be required to deliver the RT network, which are discussed in this report, but will need to be developed in more detail as MK's growth and mobility strategies are progressed.

Recommended next steps

The contents of this report, and the wider growth study being prepared by DLA, should feed into wider corporate thinking, including development of imminent rounds of local planning and transport policies.

Further development work is required to determine the detail of the RT network proposals set out in this report. Such work would build on the high-level appraisal undertaken as part of this study and should ideally focus on developing the preferred network and initial route options so that a first phase can be developed in detail, costed and appraised for DfT/MHCLG consideration through a Strategic Outline Business Case.

Such work would be consistent with the Growth Deal activities that are being undertaken in other locations in England, with potential for dedicated Housing Infrastructure Fund (HIF) and other bids to follow from this work in order to secure the funding needed to prime and deliver the first RT routes and complementary interventions (such as integrated fares, real time information, interchange facilities, Traffic Control System upgrades).

1. Introduction

1.1 Milton Keynes Council (MKC), Aylesbury Vale District Council (AVDC) and South Northamptonshire Council (SNC) are jointly considering the spatial options, and potential implications, of delivering long-term housing and employment growth focused on Milton Keynes (MK). This collaborative approach recognises the inter-connected nature of existing settlements in the area, as well as wider linkages across the South Midlands and along the Oxford – Cambridge arc.

1.2 ITP was commissioned to support David Lock Associates (DLA), which is leading this growth study. Our role has been to consider how a Rapid Transit (RT) network, focused on MK, could be delivered alongside more homes and jobs in the area. Working closely with DLA has ensured that the spatial options for growth have both informed, and been informed by, the possible extent of a RT network. Although the scope of our work has been to focus on RT, we have also considered the wider, high-level, mobility implications of the proposed strategy. This has included considering how technology might present alternative options, as well as linked opportunities for improving cycling infrastructure and better integrating other modes (car, rail, cycling, walking, bus and freight) to encourage smarter and more active travel around the MK area.

1.3 A key component of the work has been to understand how RT can be used to deliver 'good growth' for Milton Keynes. This is important because the city will continue to grow rapidly, and substantially, with or without an overarching strategy. However, unplanned growth is highly unlikely to deliver the infrastructure needed to keep pace with increasing demand for mobility and will not address the mobility inequalities that currently exist in MK. As such, it is expected to result in a more congested, less attractive city to live and invest in.

1.4 This strategy builds on previous work to develop an Innovative Mobility Roadmap, prepared as part of MK's Futures 2050 commission. The report summarises the analysis undertaken to date, sets out why a change in approach to mobility is required, presents a proposition for mobility in 2050 and considers how this might best be phased to maximise the benefits of growth for both new and existing residents. The strategy therefore seeks to demonstrate not only how RT will help deliver the new homes needed to keep pace with the city's growth to 2050, but also how growth between now and 2031 can be phased to deliver the first lines of the network early.

2. Mobility in MK: now and in the future

Mobility today

The infrastructure

2.1 Milton Keynes is recognised as one of the UK's most successful 'new towns'. It has a unique character, a strong economy and is loved by its residents. Built at low density with extensive green spaces, the city was designed around private car ownership and use – providing quick access by car from any point to any point in the city.

2.2 To facilitate this, Milton Keynes was conceived as poly-centric. Although there is a clear centre to the city, it contains around 25% of jobs, which is lower than might be expected in comparable city centres and is expected to grow significantly over the coming years. The grid road network offers fast journey times across the city by car, although certain junctions at key entry points to MK are congested during peak hours (for example junctions leading from the M1, B4034 and A422, see Figure 2-1) and average journey times have increased in recent years. Even so, traffic congestion remains lower in MK than in cities of a comparable size. To accommodate this high level of car use, parking levels are also very high – with a ratio of spaces to jobs at least double that of comparable cities (Table 2-1) – with parking charges lower than most (Table 2-2).

Figure 2-1: MK links and junctions over 85% volume:capacity in the AM peak

Source: MKC Mobility Strategy Evidence Base

Table 2-1: Parking levels in Milton Keynes and comparable towns and cities

Location	Jobs	Parking	Ratio
Milton Keynes	166,000	21,000	0.13
Northampton	124,000	4,000	0.03
Oxford	120,000	2,250	0.02
Peterborough	105,000	7,000	0.07
Cambridge	100,000	3,300	0.03
Luton	87,000	4,000	0.05

Source: MKC Mobility Strategy Evidence Base

Table 2-2: Parking charges in Milton Keynes and comparable towns and cities

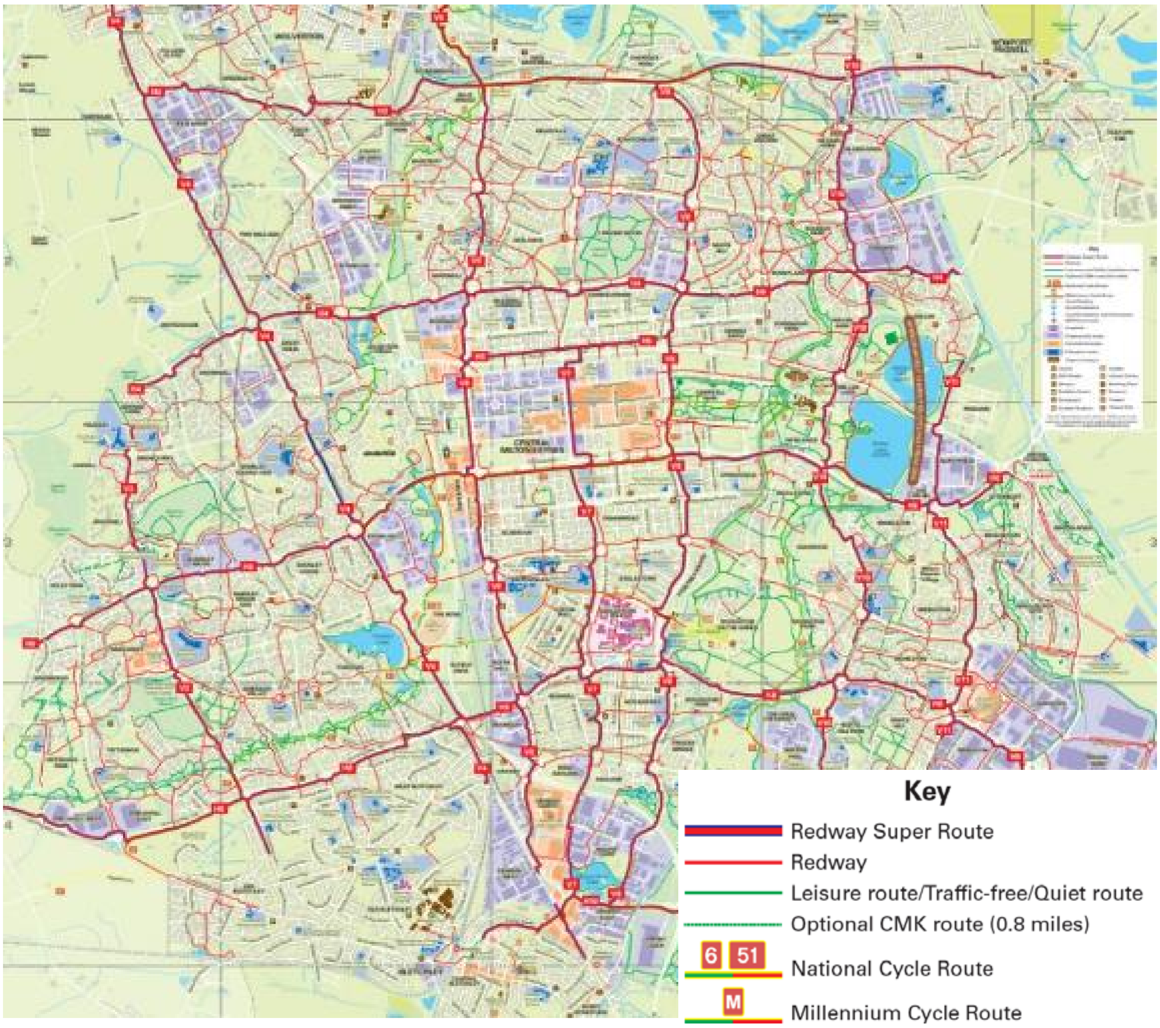
Location	Standard Tariff (£ / hr)	Premium Tariff (£ / hr)	Long-stay Tariff (£ / hr)
Milton Keynes	0.50	2.00	10.00
Northampton	0.00	n/a	7.00
Oxford	3.50	4.00	25.00
Peterborough	1.00	1.50	6.00
Cambridge	2.00	2.30	24.00
Luton	0.90	2.40	n/a

Source: MKC Mobility Strategy Evidence Base

2.3 Built alongside the grid roads, there is a dense 320km network of walking and cycle routes, known as the Redways, that provides segregated, traffic-free routes to the city centre from most locations (Figure 2-2). However, the network is not well used for day to day trips, in large part because car use is so convenient, but also because it is indirect, particularly when it crosses grid road junctions, suffers from maintenance and lighting issues and its coverage is limited within the city centre. The Redways make extensive use of subways beneath junctions and are not lined with active uses. This means there is little natural surveillance, which has led to a perception that the network is unsafe. The Redways tend to be perceived primarily as leisure cycling routes[1].

[1] MK50 Futures Report, p20

Figure 2-2: Redway network



Source: Milton Keynes Council

2.4 The bus network in Milton Keynes is relatively limited and although most grid squares are served, either directly or indirectly, services tend to be infrequent and slow in comparison to the journey times achievable by car (Figure 2-3). This is, in part, a function of the low-density design of MK, which makes the city challenging territory in which to operate commercial bus services. The necessity of picking up sufficient passengers to make the services viable means many routes either meander and stop frequently, or run along Grid Road - thereby requiring people to walk a distance from their homes and wait in less desirable locations alongside fast, busy roads.

2.5 Coupled with the low cost of car parking compared with other core cities, travel by bus is not cost-competitive with private car use in MK. Consequently, bus services are used primarily by people without access to a car, rather than positively selected based on the merits of the service. Indeed, although levels of satisfaction with the bus network in

Milton Keynes have increased in recent years, they remain among the lowest in the UK[2].

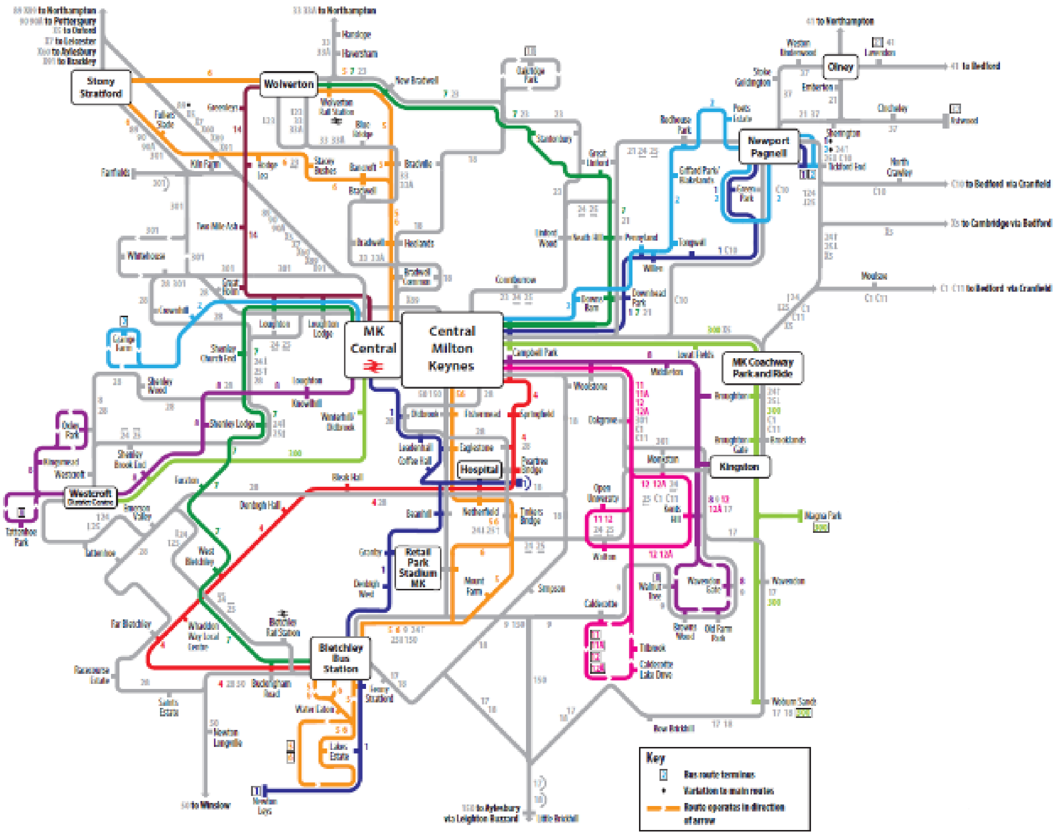
2.6 The original Plan for Milton Keynes envisaged 'equality of access for public and private transport'[3], which is consistent with a number of the goals set out in the plan, including:

1) Opportunity and freedom of choice; and
2) Easy movement and access, and good communications

2.7 The plan also envisaged that, over time, forms of public transport other than the bus could be installed, "whether of the fixed track or other more sophisticated type[4]" and the grid roads were therefore designed with substantial spare capacity to facilitate it. For a number of reasons, including rapid increases in levels of private car ownership over the last 50 years, this aspect of the original MK Plan never came to fruition. As a result, private cars have become the dominant mode of transport within the city.

[2] MKC Mobility Strategy Evidence Base, p51
[3] The Plan for Milton Keynes, Volume 1, p33
[4] The Plan for Milton Keynes, Volume 1, p35

Figure 2-3: Bus Services in MK



Source: Milton Keynes Council

2.8 There are six rail stations within the borough of Milton Keynes with the three most well used being Milton Keynes Central, Bletchley and Wolverton, which are all on the West Coast Mainline and provide direct services to London. There is limited commuting between the stations within Milton Keynes and significant 'rail heading', particularly for those commuting to London.

2.9 Outside of the borough of MK, but within the wider study area, there are stations at Aspley Guise and Ridgemont. Both are lightly-used, with an hourly service at most times of the day. Ridgemont serves the nearby Amazon warehouse and has somewhat higher patronage as a result. The second phase of East West Rail will upgrade the line from Bedford, with likely improvements in service frequency and station facilities - particularly related to new development. To the west of Milton Keynes, a new station is also proposed at Winslow as part of East West Rail, with further scope for a new station at Newton Longville.

The outcomes

2.10 Consequently, the majority of people working within Milton Keynes choose to travel by car. As can be seen in Table 2-3, 65% of people drive to work by car, with a further 7% travelling as passengers. Only 7% travel to work on foot, 6% by bus and 3% by bike.

Table 2-3: Journey to work mode share in Milton Keynes

Method of travel to work	All persons	Percent
Driving a car or van	79,479	65
Work mainly from home	12,598	10
On foot	9,150	7
Car passenger	8,084	7
Bus	7,065	6
Bicycle	3,611	3
Other	2,693	2
Total	122,675	100

Source: 2011 Census

2.11 There are several significant implications that arise from these car-centric patterns of travel that could not easily have been foreseen when the city was being planned.

2.12 The first of these relate to the implications on **public health** resulting from a lack of physical activity. Around 75% of adults are overweight or obese – the highest rate in the region – with around 19% of year six students being classified as obese. Related to these factors, the average life expectancy in Milton Keynes is below the national average. As well as **life expectancy** being lower overall in Milton Keynes, men living in the most deprived wards live around seven years shorter on average, while women live for an average of five less years[5].

2.13 Levels of **deprivation** in Milton Keynes are increasing relative to the rest of the UK[6], with lower car ownership common in areas with higher levels of deprivation (Figure 2-4). Those without access to cars also do not benefit from affordable and quick access

[5] MK50 Futures Report, p16
[6] Ibid.

to employment, social and leisure opportunities available in Milton Keynes. In total nearly 20% of the population do not have access to a car in Milton Keynes, with many more not having daily access[7].

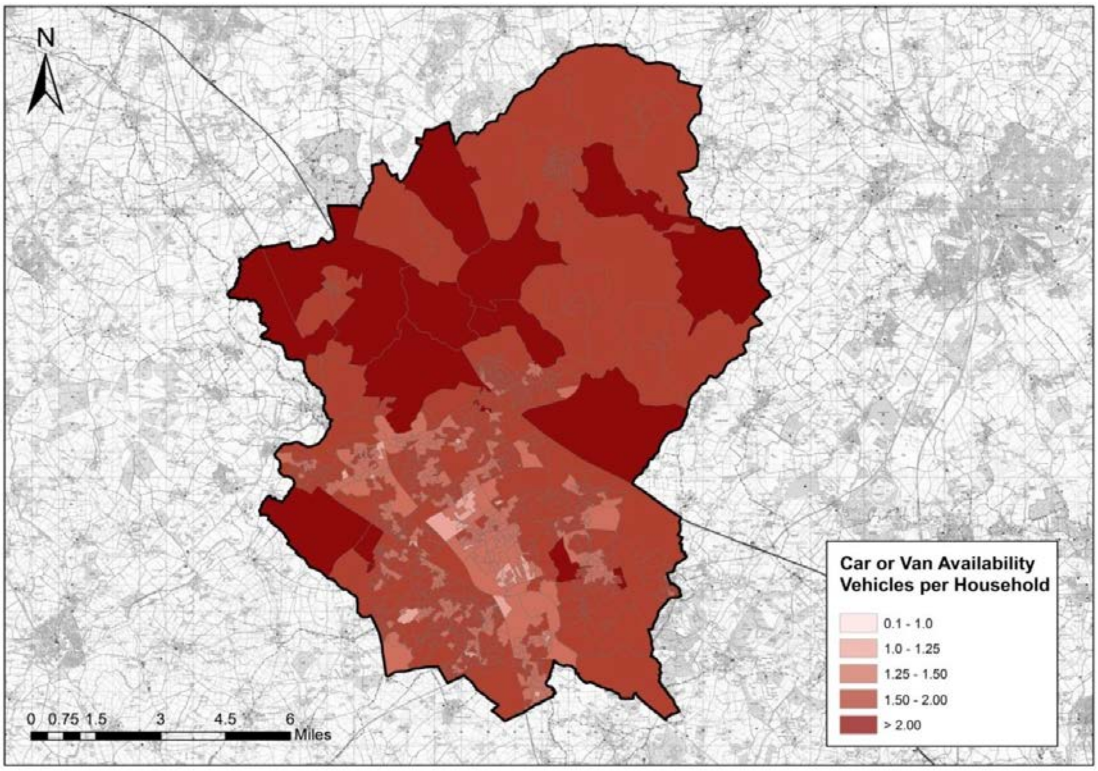
2.14 To determine the impact of not having a car in Milton Keynes, public transport accessibility analysis was undertaken making use of TRACC, a multi-modal transport accessibility tool. **While all residential destinations with the city are within a 20 minute drive to the city centre by car, only 23% of the population is currently within 20 minutes of the city centre by public transport** (Table 2-4). This results in significant mobility inequalities in the city for those residents who do not own a car.

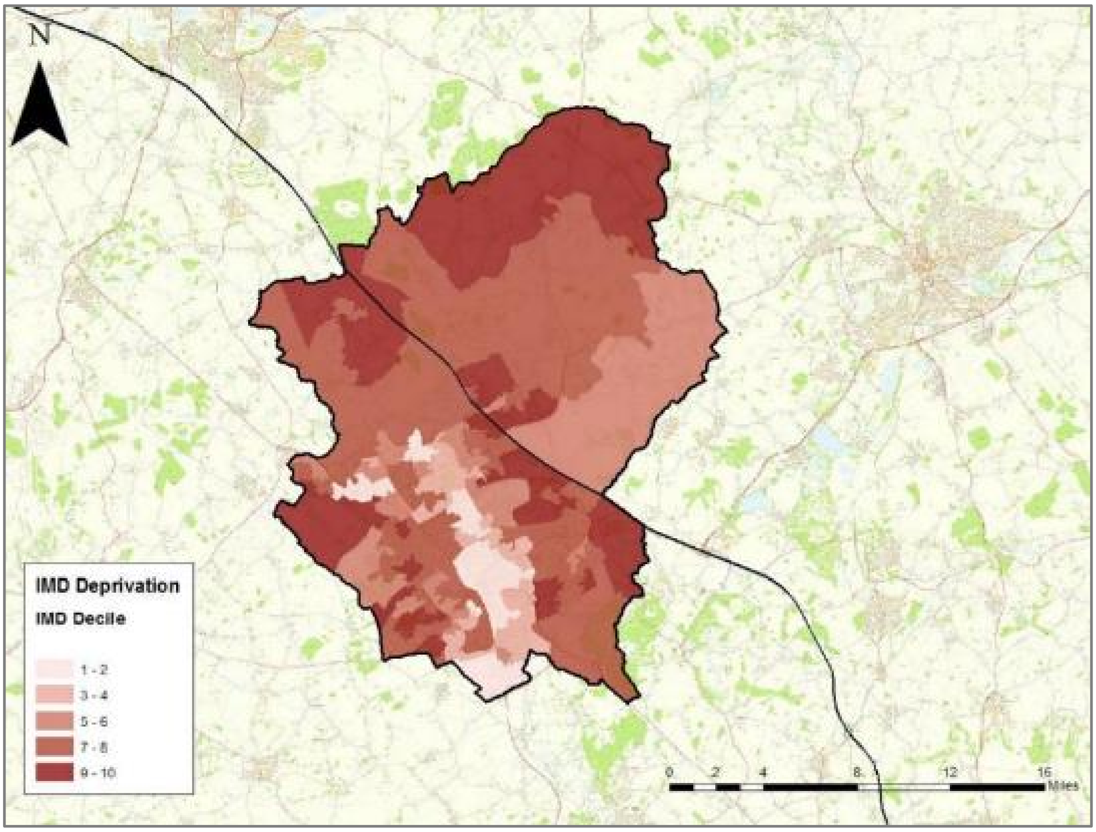
Table 2-4: Population within 800m of public transport network and travel time journey time bands[8]

Journey time to centre (station)	Population within time band	Cumulative proportion of population
0-10	5,482	1.8%
10-20	62,788	23.0%
20-30	89,765	53.3%
30-40	60,350	73.7%
40-50	39,402	87.0%
50-60	38,655	100.0%
Total	296,442	-

[7] MK50 Futures Report, p46
[8] It should be noted that the population figures in Table 2-3 include areas outside of the borough of Milton Keynes

Figure 2-4: Levels of deprivation (top) and car ownership (bottom)



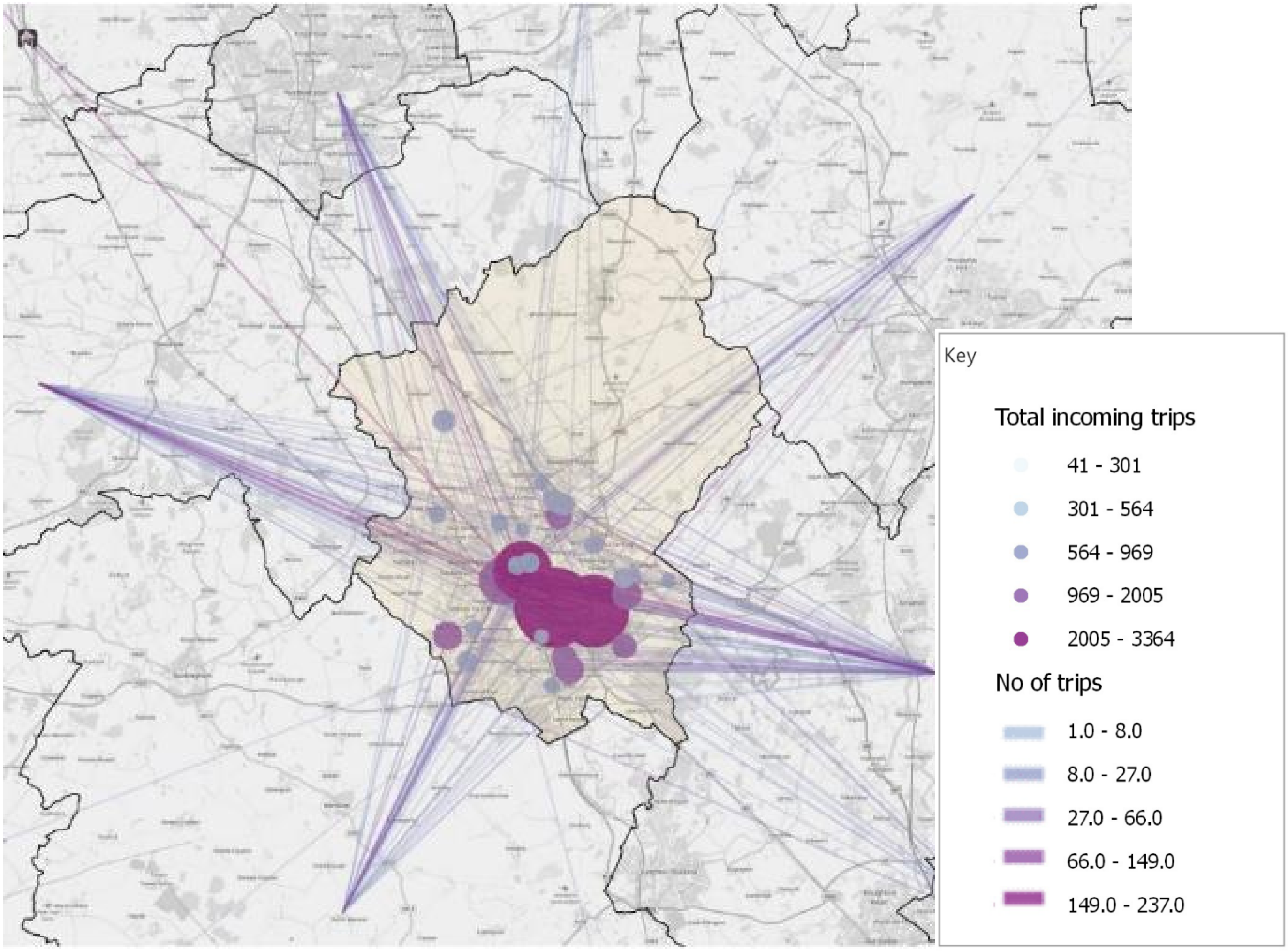


Source: MKC Mobility Strategy Evidence Base

2.15 A further implication of the car-dependent nature of Milton Keynes is that **per capita emissions of CO^2** are in the top 10 for the UK, despite being a 'new town' with relatively new building stock and infrastructure. The IPCC recently reported an urgent need to reduce carbon emissions if we are to halt irreversible climate change.

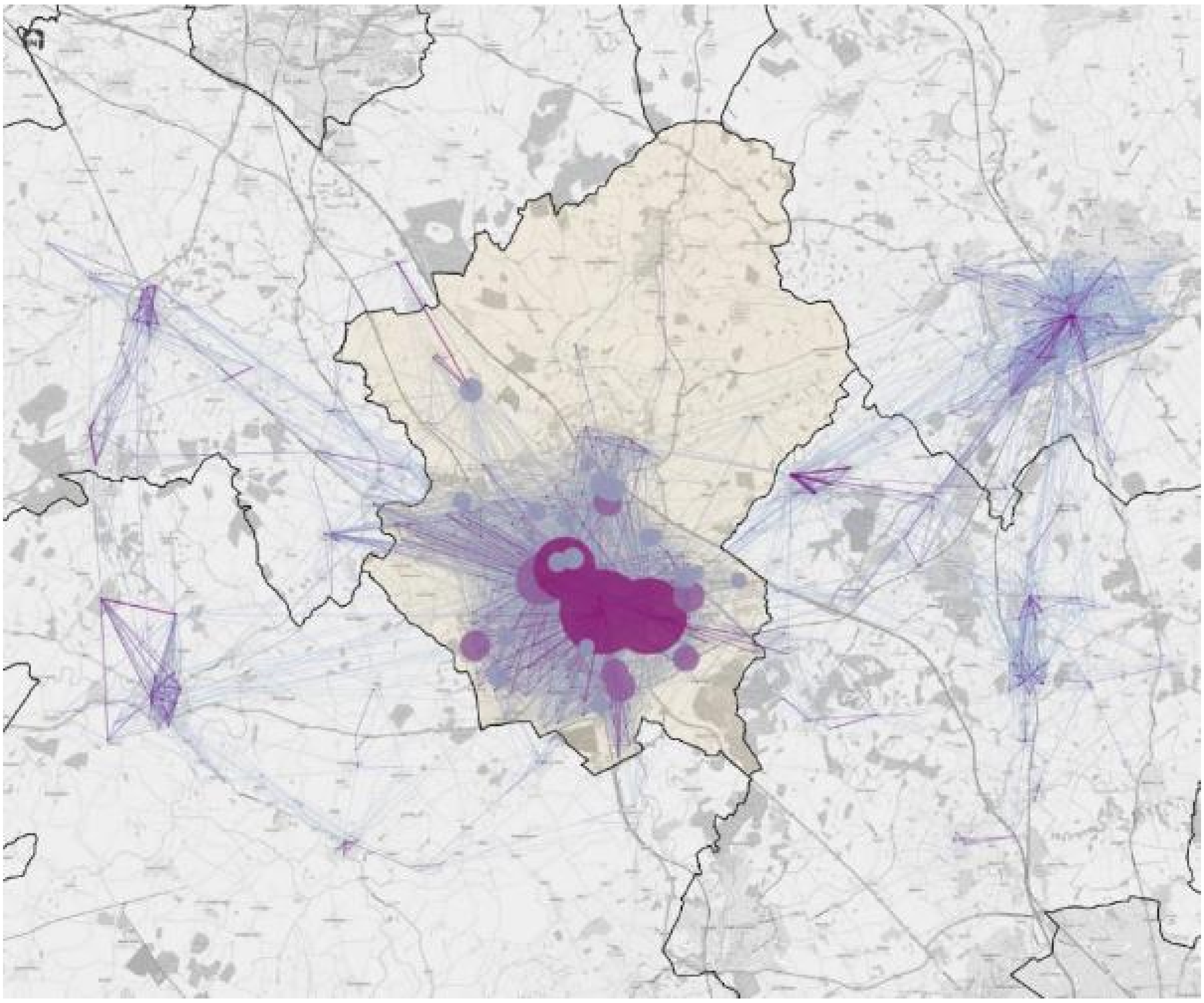
2.16 ITP's analysis of Census (2011) travel to work data indicates that Milton Keynes draws in workers from across adjoining settlements such as Bedford, Leighton Buzzard, Luton, Buckingham and Northampton (Figure 2-5). There are also important movements from smaller settlements such as Olney, Cranfield and Towcester to Milton Keynes and a web of movements between settlements around Milton Keynes (Figure 2-6).

Figure 2-5: Trips from Local Authority Districts into Milton Keynes with key destinations shown



Source data: Census 2011

Figure 2-6: Trips from all LSOAs within 10km of CMK with key destinations shown



Key

· LSOA 'start points'

Total incoming trips

- 41 - 301
- 301 - 564
- 564 - 969
- 969 - 2005
- 2005 - 3364

No. of trips

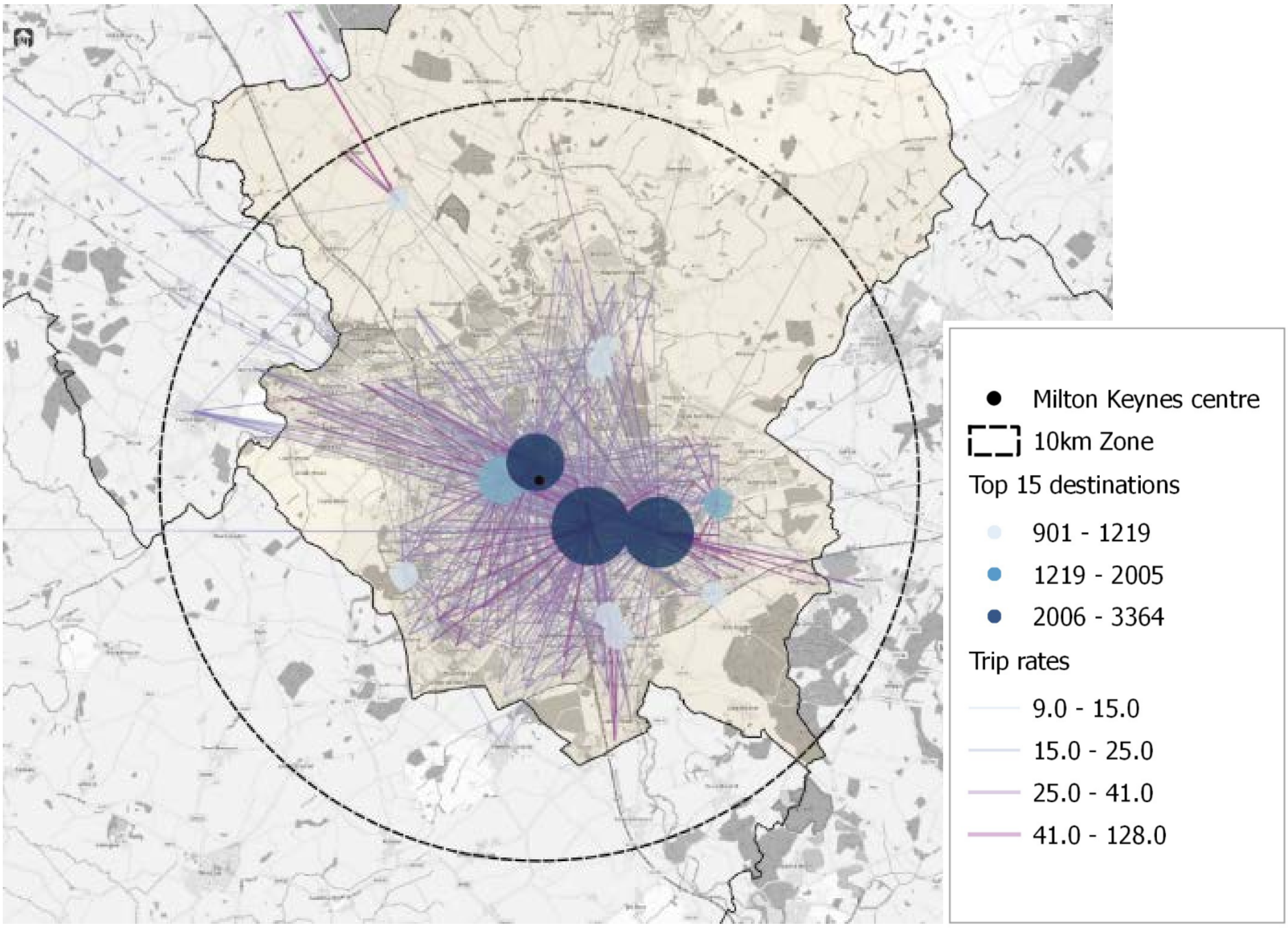
- 5.0 - 9.0
- 9.0 - 15.0
- 15.0 - 25.0
- 25.0 - 41.0
- 41.0 - 128.0

Source data: Census 2011

2.17 Despite this relatively wide travel to work catchment it is important to note that the majority of trips to workplaces within the urban area also originate there. Of the 122,000 work trips with a destination within the borough of Milton Keynes, 78,000 (64%) originate within Milton Keynes[9].

2.18 Milton Keynes' poly-centric nature results in some trips going both into, through and around CMK with corridors of north–south and east–west travel demand. However, the most common commuter destinations are clustered around the centre and include CMK, the hospital and the Open University, with smaller clusters around Bletchley, Shenley Wood, Kingston and Tongwell (Figure 2-7), being accessed from outside the centre.

Figure 2-7: Trips to and from the top 15 Workplace Zone destinations within Milton Keynes



Source data: Census 2011

[9] Census 2011 WU03EW - Location of usual residence and place of work by method of travel to work (MSOA level)

Future demand for travel

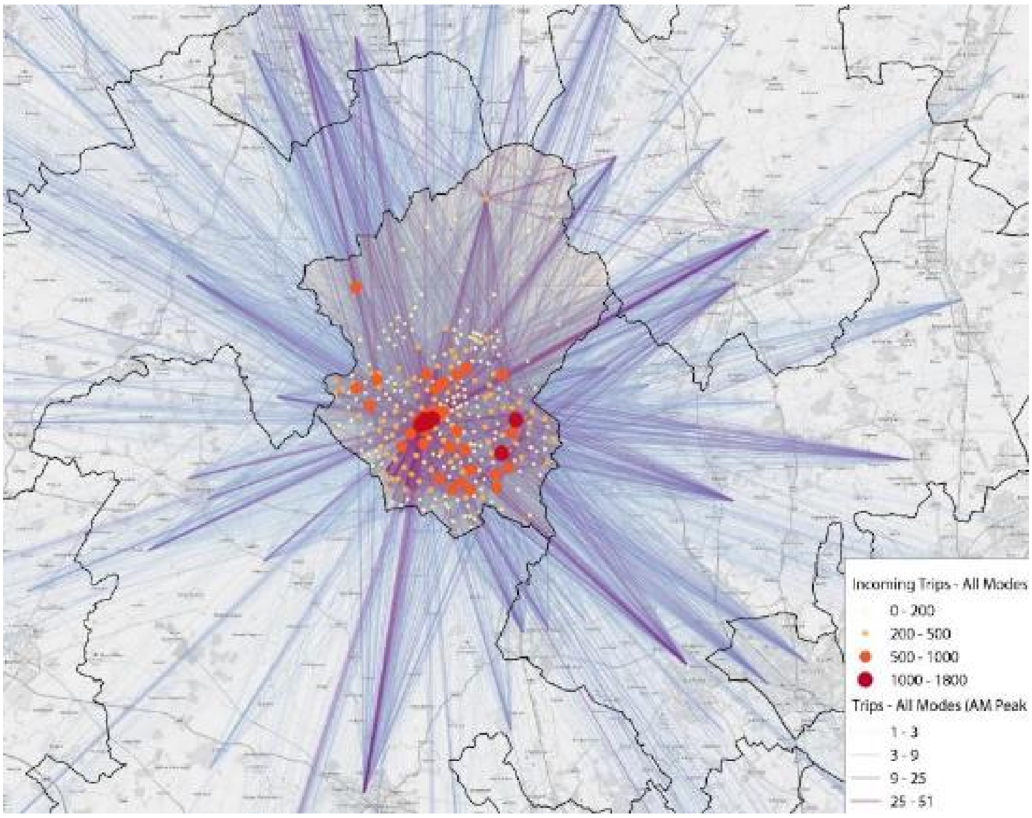
Movement patterns

2.19 The key aspiration underpinning the growth study has been that the population of Milton Keynes should grow from around 260,000 today to 500,000 by 2050. This reflects the fact that Milton Keynes has the fastest growing economy in the UK[10] and that, even without any long-term strategy in place, the population is projected to rise to ~436,000 by 2050[11].

2.20 In order to clearly understand the implications of the rapidly growing population on movement within the city, origin-destination matrices from the Milton Keynes Multi-Modal Model (MKMMM) were provided by Milton Keynes Council (MKC) for 2016 and 2031. These include spatial growth being allocated in Plan:MK (undergoing Examination in Public at the time of this study), as well as forecast changes resulting from growth in neighbouring areas. The data provided was for private vehicles only, so we used Census 2011 travel to work mode share values to infer the number of total motorised trips (i.e. by private car and public transport modes). By 2031 the pattern of movement depicted in the Census data can still be seen, with significant movement from adjoining settlements and a strong cluster of trip destinations in the centre of MK. Additional locations become important destinations, particularly the Plan:MK sites to the south east of the city, (Figure 2-8). By 2031 intra-city movement remains important with 67% of all trips starting and ending within the Borough of MK.

[10] MK50 Futures Report, p36
[11] Based on Objectively Assessed Need projections compiled by DLA

Figure 2-8: 2031 all trips with key destinations shown



ITP's analysis of the MKMMM origin-destination outputs identified how demand across the city will change between 2016, 2031 and 2050. The additional growth included in the 2050 scenario relates to the locations of regeneration sites (Renaissance:MK) and the growth locations developed by DLA in parallel with the RT proposals (see

2.21 Figure 2-9). A series of heatmaps have been produced that show how the intensity of movement within the city is forecast to change between now and 2050 (Figure 2-10).

2.22 These Figures demonstrate how the areas of intense movement are predicted to expand out from the city:

- In 2016 the key 'hotspot' for demand is around 5-2with lower but still significant demand around the other major centres such as Bletchley, Wolverton, Stony Stratford, Tongwell and Kingston.
- By 2031 demand grows steadily in CMK along with the western expansion area and other areas of allocated housing and employment, especially to the south and south east of the city and to the south east of Newport Pagnall.
- By 2050 growing demand with CMK and significant growth in demand around the new growth locations to the north, north-east, south-east and south-west. The growing intensity of movement around CMK is consistent with the expected growth in total city employment within the centre, from c25% to c33%.

2.23 As part of the technical work undertaken for Plan:MK, the impact of the forecast growth to 2031 on the highway was modelled using the MKMMM. This testing indicates that by 2031 vehicle journeys time will increase by 14% in the AM peak and the number of junctions approaching, or over, capacity will also have increased - particularly around CMK and despite planned investment in the highway network (Figure 2-11). The consequences of this will be greater congestion and increased 'grid lock' at peak times by 2031, which is expected to focus on key gateways into the city.

2.24 Looking forward to 2050 there will be very substantial additional growth in movement generated due to 70,000 more homes being delivered beyond the modelled year of 2031 and significant continued employment growth in CMK, which might contain up to 60% of the city's office floorspace. The outcome of this will be continued and significant deterioration in journey times and congestion beyond the Plan:MK period in a 'more of the same', private car led mobility scenario. The additional demand for car parking would also compromise the quality of the environment and reduce the potential plot ratios achievable within CMK.

Figure 2-9: Key points of demand

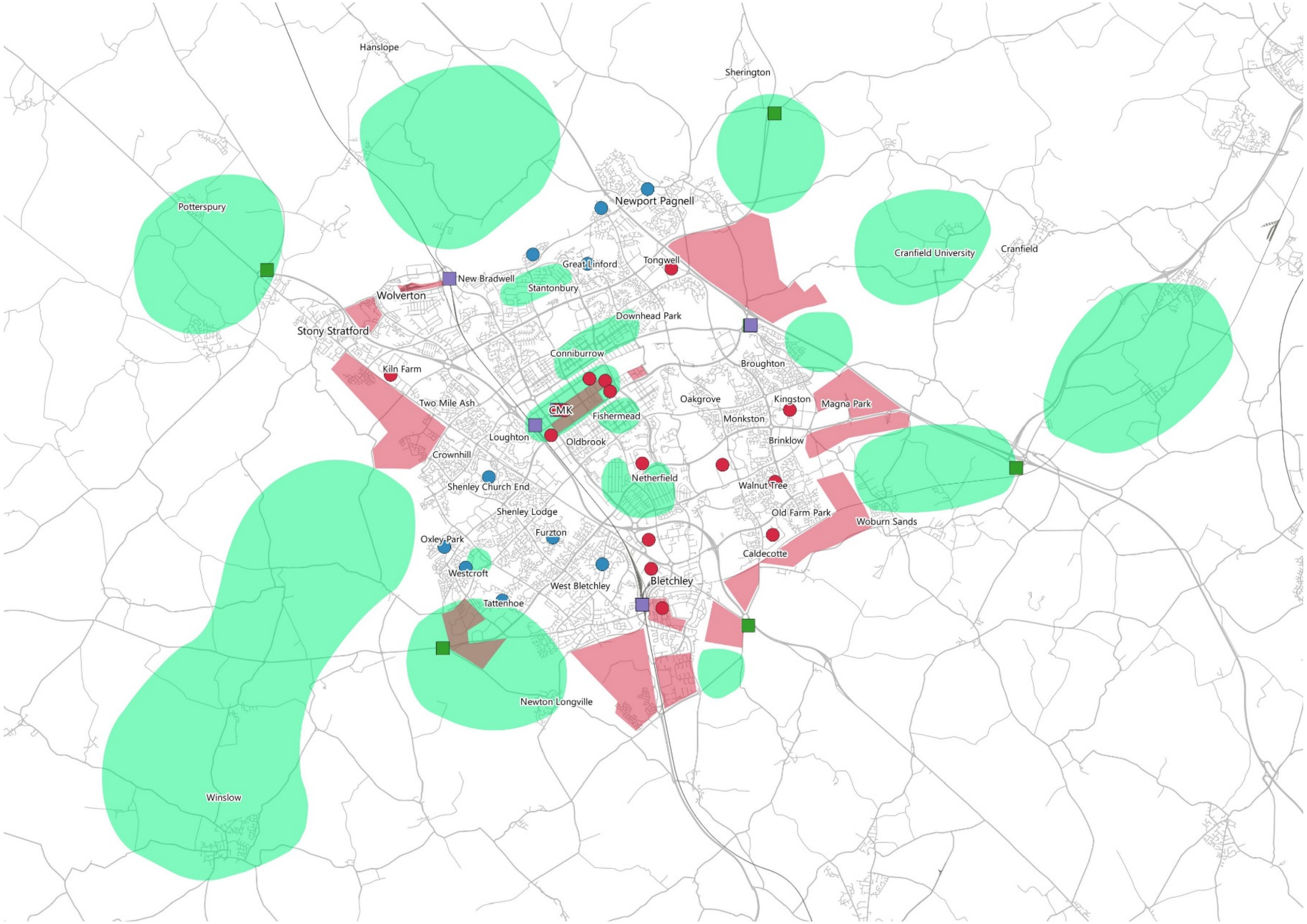
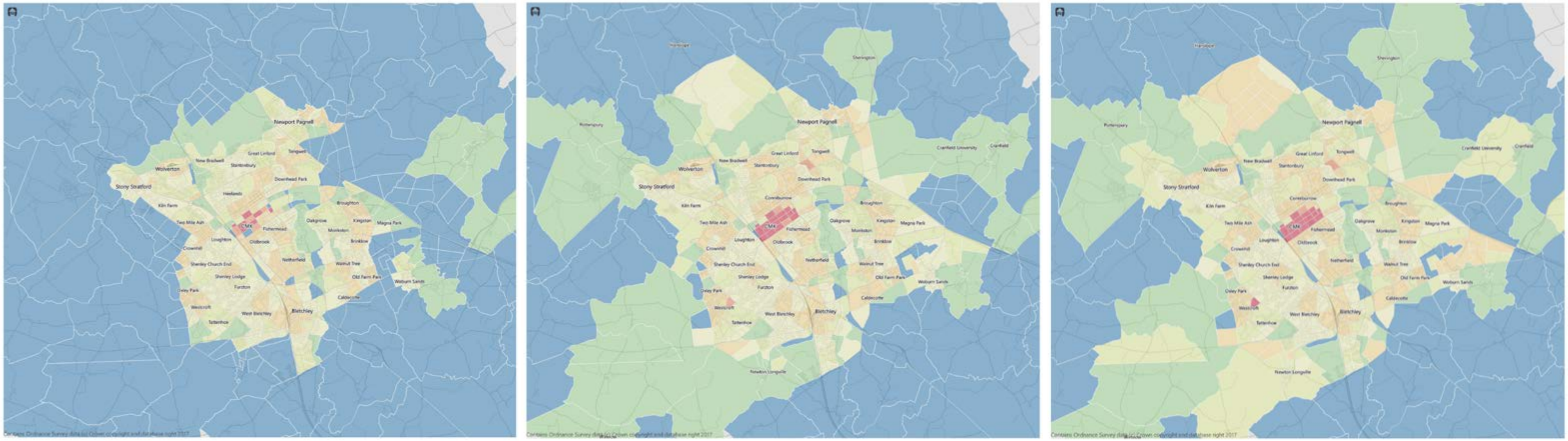


Figure 2-10: Heatmap showing volume of trip ends (origins and destinations) in 2016, 2031 and 2050

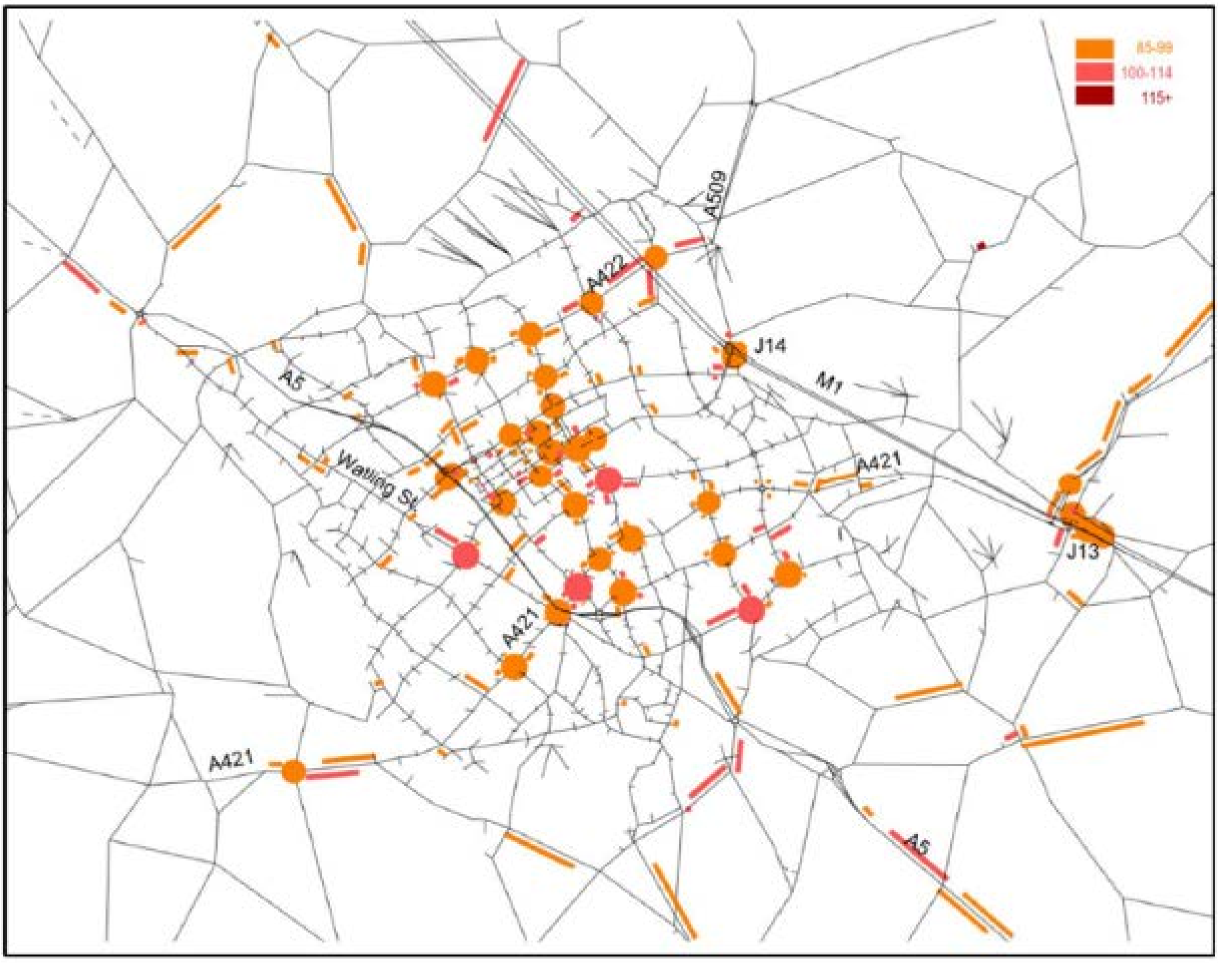


Key

Trip Ends per km2 - All Modes AM Peak (2016)

- 0 - 100
- 100 - 400
- 400 - 800
- 800 - 1200
- 1200 - 4000
- 4000 - 6000
- >6000

Figure 2-11: 2031 congestion hotspots showing all links and junctions with volume to capacity ratio over 85% in the AM peak



Source: MKC Mobility Strategy

2.25 The Mobility Strategy adopted by MKC aims to reduce private car use for commuter trips from the current average of 65% to 50%. However, in the context of roughly doubling overall demand for travel in the city as the population doubles, achieving this target will still result in a 50% increase in traffic levels compared with today. As demonstrated by the Plan:MK modelling work to 2031, this scale of growth cannot be accommodated within the current grid road network. The scale of the challenge, and the need for a new approach to mobility, is acknowledged in the MK50 Futures Report, which states:

> *"the city cannot meet the very high costs of rebuilding key road junctions and other network improvements that would be needed to avoid gridlock and keep pollution under control. Other ways*

must be found to provide mobility for all, and those options must be more attractive and convenient than using the car."

2.26 The construction of new highway capacity in isolation does not provide a long-term solution to existing problems of traffic congestion. Research over several decades has repeatedly demonstrated that building more roads to solve traffic congestion is not effective, because it often leads to significantly increased traffic levels overall by inducing extra demand and attracting higher traffic volumes onto the surrounding network[12][13][14].

2.27 Furthermore, even if additional highway capacity could solve the existing and future congestion problems from a car-based mobility strategy, the mobility inequality issues set out above would not be addressed and Milton Keynes would continue the trend of being an increasingly 'two-speed' city, with the life chances for those without a car significantly constrained. In addition, the health of all future residents in this scenario would also be compromised due to the reduced physical activity that characterises an overdependence on the car. This would exacerbate the existing obesity problem and result in a less fit and healthy population. CO^2 emissions per capita are also likely to remain some of the highest in the UK, even with greater adoption of electric vehicles.

Technological and societal shifts

2.28 Milton Keynes is at the forefront of transport innovation. It leads the UK in electric vehicle infrastructure, it hosts multiple autonomous mobility technology projects (including self-driving cars, delivery robots and pods), and has launched an on-demand bus service as well as dockless electric bikes. The way people move around is expected to change dramatically by 2050, and MK is well placed to embrace these changes.

2.29 There is likely to be increasing autonomy in the vehicle fleet. Public transport services are likely to become more responsive to user needs and more 'on-demand'. Greater home and remote working are also predicted to change conventional patterns of travel demand. At the same time the UK population will continue ageing, with an expectation this will necessitate increasingly seamless door-to-door travel across all modes. Traditional car ownership models are predicted to continue declining in popularity, as has begun in recent years, with take up of driving licenses expected to continue reducing among the young. The use of big data and mobile computing is likely to bring together multiple modes of transport into one seamless travel experience, at

[12] SACTRA, 1994: Trunk Roads and the Generation of Traffic
[13] Phil Goodwin, 24 August 2006 Induced Traffic again. And again. And again. *Local Transport Today, 450* (available: http://stopcityairportmasterplan.tumblr.com/post/19513243412/induced-traffic-again-and-again-and-again)
[14] CPRE, 2017: End of The Road

least at the local level. There are likely to be significant new and as yet unforeseen technologies and social changes that will influence the way people travel by 2050.

Figure 2-12: Dockless electric hire bikes recently launched in Milton Keynes

Source: Kris Krüg/Lime

2.30 The potential for significant change into the future means that whatever propositions are put forward now must be flexible and able to operate under multiple future scenarios. This is considered in more detail in Section 6. However, the core ingredient for successful growth is the concept of ‘mobility for all’. This is set out in the MK50 Futures Report and seeks to ensure that *“everyone who lives, works, studies or does business in Milton Keynes must be able to move freely and on demand.”* Ensuring that opportunities created by the growth of Milton Keynes are accessible to all, and that existing inequalities are reduced, requires future growth to be considerably less-reliant on car ownership and usage.

2.31 The successful growth of Milton Keynes to 2050 and the delivery of an efficient and high capacity transport network are therefore intrinsically linked. ‘Business as usual’ cannot accommodate the aspiration for growth. Even in a scenario where there is significant uptake of autonomous vehicles and greater capacity can be extracted from the highway network, the substantial growth in demand forecast and the inherently inefficient use of space reflected in private car travel, means more efficient ways of moving people around Milton Keynes will be required.

2.32 A change in approach from personal mobility to 'smart, shared, sustainable mobility', will not only be essential to ensuring equitable access to jobs and opportunities, but is also a prerequisite for doubling the size of the city in terms of maintaining an efficient network and managing congestion. Change takes time and, as the Plan:MK modelling work has shown, it is vitally important that changes are set in motion now if MKC is to alter the course of future mobility in the city - rather than waiting for gridlock to force a change in approach that will be significantly more difficult to achieve. The challenge of phased delivery of RT and spatial growth is therefore considered in Section 7.

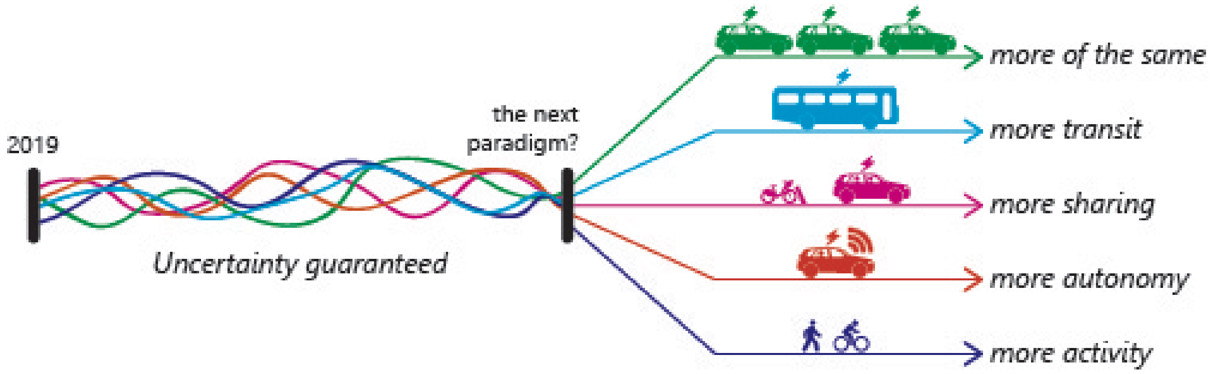
2.33 The scale of growth anticipated in Milton Keynes, if properly harnessed, provides the opportunity to deliver 'smart, shared, sustainable mobility' and improve the quality of life for all those who live and work in the city. Several key transport issues arise from the proposed growth of Milton Keynes from 260,000 to 500,000 by 2050 as summarised earlier in this report.

3. Responding to MK's mobility challenges

Future mobility trends

3.1 To understand what future mobility trends might look like in Milton Keynes, this report has drawn on the Future Mobility Roadmap produced by ITP on behalf of MKC as part of the MK50 Futures Commission. This roadmap suggested that the shape and detail of the next 'mobility paradigm' remains uncertain. Depending on which smart mobility technologies and services come to fruition (Figure 3-1), and when they are widely adopted, there is a wide range of possible outcomes for how people choose to travel.

Figure 3-1: Possible future mobility outcomes for MK



3.2 The future mobility work previously undertaken considered five potential technological scenarios and their likely outcomes in Milton Keynes across a range of themes including spatial growth, economic growth, people and place, culture and innovative mobility. A summary of this analysis is set out in Table 3-1.

3.3 The analysis highlights that 'more of the same' will not result in transformational or 'good growth' in Milton Keynes, but in more sprawl and congestion and less active travel with associated health impacts. A 'more of the same' future does not deliver mobility for all, as has been discussed in Section 2.

3.4 The adoption of technological solutions, particular CAVs ('more autonomy'), on its own is unlikely to dramatically shift the status quo away from the use of cars in Milton Keynes. Such technologies may be able to increase highway capacity and, if regulated in such a way as to encourage shared use, vehicle utilisation could be increased while providing cheaper access to vehicles. However, CAVs also have the potential to substantially increase demand in a private ownership scenario, through reduced vehicle occupancy levels and widened access to personal car travel.

3.5 Therefore, the introduction of autonomous technologies into the car fleet will need to be carefully managed through use of appropriate regulatory frameworks and charging mechanisms that encourage sharing, control access and discourage 'empty' vehicle miles. If instead the introduction of such technology is led by the market, CAVs are more likely to simply replace private cars, substantially increasing private car mileage and congestion and decreasing use of public transport. Within the core urban areas, where vehicles mix with pedestrians and cyclists, the potential capacity benefits may be reduced through the more cautious driving required from CAVs.

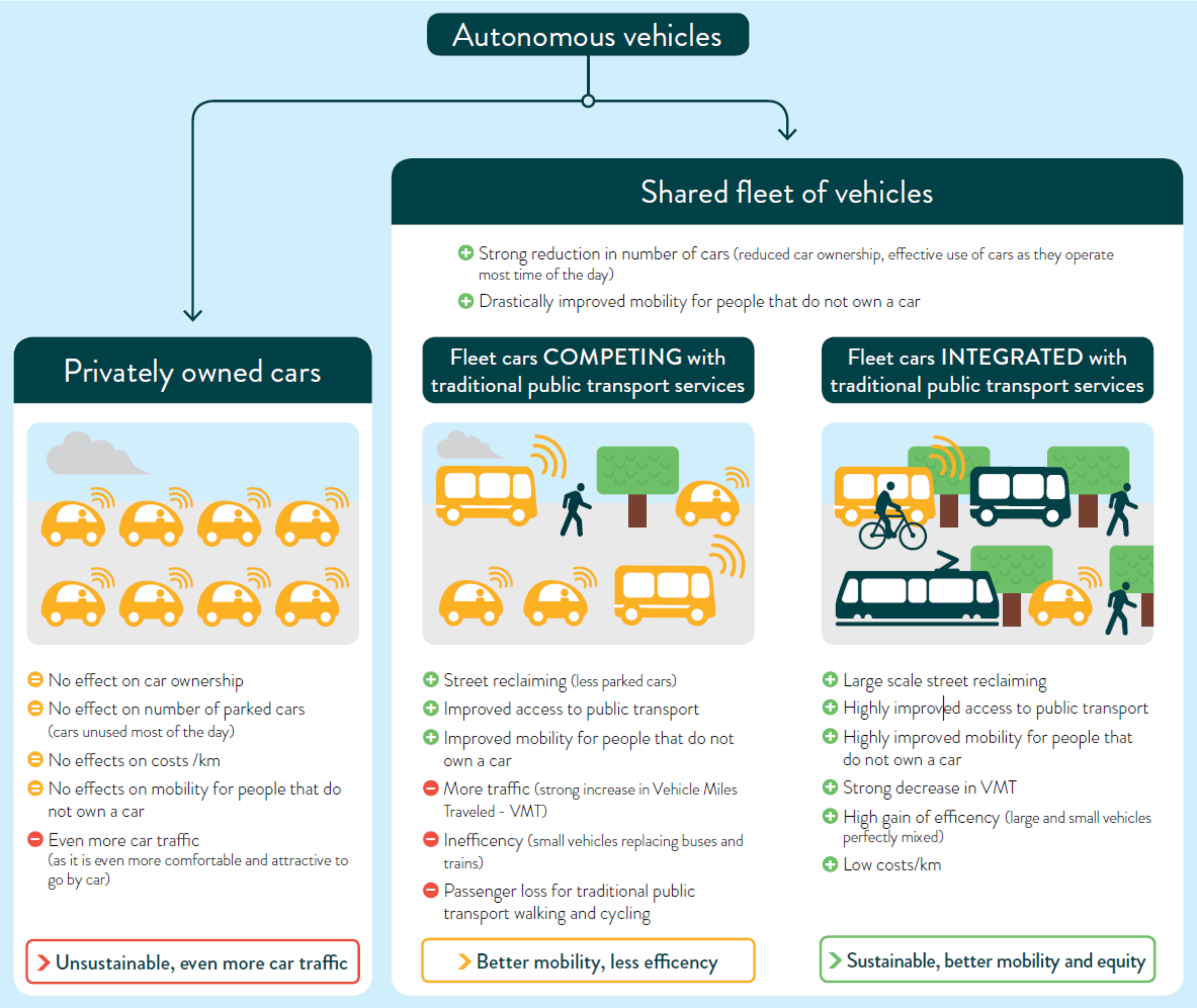
3.6 Nonetheless, autonomous vehicles ('more autonomy') will have an important role to play in delivering 'smart, shared, sustainable mobility' as they can feed into core public transport networks and satisfy a 'first/last mile' demand. In this scenario, the overall vehicle fleet can be dramatically reduced, the catchment for public transport increased, while overall mobility, and equality of access to mobility, is increased[15] (see Figure 3-2).

3.7 A future with 'more activity' would deliver substantial health, congestion air quality and productivity benefits. However, this may not be suitable for the more dispersed communities in the existing city and would require more Transit Oriented Development (TOD) in the future. Therefore, this scenario is unlikely to be appropriate on its own but will be central to satisfying 'first/last mile' demand, while improved walking and cycle infrastructure can encourage a greater proportion of short trips to be undertaken by active modes than are currently.

3.8 'More transit' and 'more sharing' are highly compatible futures that would deliver positive outcomes through supporting more greater efficient use of land and resources though selectively densifying at key locations and reduced levels of parking, encouraging economic growth along new transit routes, while capitalising on innovation, while delivering fairer access to new jobs and services by prioritising shared modes of transport available to all. However, these scenarios require strong leadership in order to deliver the supporting measures for both futures. It is likely that the future will include a combination of some or all of the scenarios described above and summarised in Table 3-1.

[15] UITP, 2017: Autonomous vehicles: a potential game changer for urban mobility

Figure 3-2: Impact of different models of CAV uptake on mobility outcomes



Source: UITP/ Martin Röhrleef

3.9 In order to achieve 'good growth' a new transport proposition is required, one that moves away from the private car and delivers 'smart, shared, sustainable mobility'. At the core of this offer should be a trunk network of high capacity RT services. This network should be substantially segregated, taking advantage of the reserve land set aside along the grid road corridors and with priority through junctions. The spatial arrangement of development and its density will both respond to this network and provide the patronage to make it viable. This study has focused on how a RT network can be delivered for the city that delivers improved infrastructure for active travel and is flexible enough to accommodate a wide range of transport services in the future. The key ingredient for any RT network will be that it must be flexible and able to adapt to change.

Table 3-1: Summary of potential impacts for MK 2050 research themes

Theme	Potential impacts				
	More of the same	More transit	More sharing	More autonomy	More activity
Spatial growth	Low densities based around extended grid corridors	Higher-density corridors linked by demand-responsive transit / rail services	Reduced parking requirement, scope to plan space in CMK differently	Transformational, if combined with other innovations/futures	Best supported by denser environments with shorter distances
Economic growth	Limited benefit from agglomeration	Attract/incubate/exploit PT delivery innovators & new skills	Sharing economy could create new local capabilities	Autonomous vehicle tech / design / data / infra opportunities	Productivity gains from increased health of workforce
People & place	Sustainable? Urban dispersal limits active travel & shared mobility	Supports more inclusive development and sustainable growth	Greater social interaction, lower travel costs, PAYG options	Space for cycling? Jobs? Favours independent (auto) mobility	Public health & wellbeing, active places, better AQ/environment
Innovation culture	Swimming against the ‘SMART’ mobility tide, inhibits scope for revolution from car-dominated society	Demand-responsive services, coupled with deeper integration of existing travel options; low carbon benefits	Sharing economy opportunities related to smart mobility	Autonomy itself, Human Machine Interfaces, user research, testbed culture	Human performance measurement, smart bikeshare services, enhanced active + motorised integration
Innovative mobility	Modest optimisation, but sprawl means congestion is likely to worsen	More space-efficient growth with ‘green’ links to outlying settlement	Reduced car-dependence most likely in parallel with other ‘futures’	Re-define roads, increase road utilisation, safety & in-trip productivity	Reinvigorate use of Redways to mitigate potential risks from autonomous modes

Rapid Transit benefits for MK

3.10 A RT network would represent the backbone of a new mobility offer for Milton Keynes that combines the future scenarios described above. It will allow the city to grow, while respecting and responding to its original form and low-density nature in existing communities. It will be the key component, and a significant driver for, wider uptake of Mobility as a Service (MaaS), which MKC intends trialling in the near-term. In short, RT provides a robust response to the need for change and the challenges of growth.

Rapid Transit will help to deliver:

- **Improved efficiency**, moving more people in less space and responding to the growing demands of a larger population.
- **Mobility for all**, allowing the opportunities created by growth to be accessible by all affordably, whether or not they own a car.
- **Reliable journey times** into the city centre, by promoting a mode shift away from the car and providing a high degree of segregation from general traffic.
- **Healthier life styles**, increasing opportunities for walking and cycling and by allowing new Transit Oriented Developments to be created and delivering on the principles of the NHS Healthy New Towns programme.
- **Improved environment**, protecting and enhancing the quality of Milton Keynes and respecting the original vision.
- **A 21st Century city centre** that serves as the heart of the Cambridge, Milton Keynes, Oxford arc.
- **Economic growth** by improving competitiveness (attracting and maintaining talent) and reducing congestion.
- **A positive response to climate change** by reducing per capita CO_2.
- **Good growth**, by planning the anticipated growth to happen in a way that achieves the outcomes above.

Opportunities of Rapid Transit-led growth

3.11 In contrast to 'more of the same' development, which would not deliver significant new infrastructure, planned growth can deliver a higher quality environment, enhanced walking and cycling infrastructure and a step change in public transport provision. Such planned growth will foster development in the right locations, to a high standard, and in a way that safeguards and funds infrastructure. By building RT proposals into such growth there is a considerable opportunity to delivery the aspiration of 'Mobility for All' set out in the MK Futures 2050 work. Key benefits are set out in this sub-section.

Improving Travel Options

Inclusive alternatives to private motorised travel

3.12 By allocating land around RT routes and nodes and designing at higher density than has traditionally been the case in Milton Keynes, planned new communities can provide a base of demand that makes RT services viable, while ensuring a significant proportion of the new population have access to high quality public transport from the outset.

3.13 The RT network would be supported by a network of local bus services, lower capacity on-demand transport services, cycle hire, car club and taxi services that taken together solve the 'first/last mile' problem. The range of services highlighted above would be brought together in a single user interface, Mobility as a Service platform and in time would include shared CAVs.

Smarter use of parking infrastructure

3.14 Through improving alternatives to the car, the need for car parking may be reduced, particularly around CMK and in new development. This process may be accelerated by adoption of autonomous technologies. The land thus released can be utilised for other land-uses, helping to add vitality to the city centre while driving demand for RT.

Future-proofing journey times

3.15 The RT route alignments must be largely segregated from general traffic, with priority at junctions, in order to secure reliable journey times regardless of levels of congestion on the wider highway network. Ensuring reliable journey times that are faster than travel by private car, will be an essential element of delivering higher public transport mode share. By providing dedicated cycle infrastructure along with the RT network, more direct cycle routes can also be delivered, helping to encourage greater cycle mode share.

3.16 It is assumed that, at least during peak hours, the RT network would be dedicated to RT vehicles. However, out of peak hours access could be expanded to include servicing vehicles, as part of a wider consolidation and servicing strategy, as well as autonomous vehicles as technology develops.

Integration across transport modes

3.17 The RT network will fulfil a trunk network role, carrying a high volume of passengers along key routes into the city. In low density Milton Keynes this network may need to be supported by a range of local 'first/last mile' transport services that are well integrated and complimentary.

3.18 As well as encouraging higher density development around the RT stops, it is anticipated that the stops themselves would take the form of mobility hubs. Mobility hubs provide access to a wide range of transport and other services. The hubs would also connect to high quality walking and cycling networks, linked to the Redways, and will allow users of the RT network flexibility in how they access the network, widening its catchment. Such hubs would be an important physical expression of the RT network but also of the wider concepts of Mobility as a Service and a key element in delivering a compelling 'first/last mile' strategy.

Responding to future changes

3.19 As discussed in Section 2, there are significant technological shifts on the horizon that are likely to have profound effects on the way people move and the services that are available to them. A network of highly segregated routes offers significant flexibility to accommodate such changes due to the highly predictable running environment, with limited mixing of modes. For instance, this offers the perfect environment for the introduction of autonomous vehicles as the technology matures.

3.20 A range of additional services could be given controlled access to the RT network infrastructure. These might include freight vehicles connecting a network of consolidation centres, which would allow quick journey times across the city unimpeded by congestion. Semi-public transport services such as taxis, or demand-responsive minibuses, could also be provided with access alongside local buses. Access would need to be managed to ensure performance was maintained for the trunk RT services, however opening up the network could provide multiple benefits as well as generating additional income though access charges.

3.21 The flexibility needed to enable this is likely to be best achieved if the RT option for Milton Keynes is rubber-tyred in nature, since the running lanes can be more flexibly utilised by other modes.

Figure 3-3: A Mobility Hub in Hamburg, Germany

Source: Sophia von Berg

Improving Opportunity and the Environment

Spreading the benefits of development

3.22 The building of up to 100,000 additional homes to 2050 will substantially increase demand for movement within the city. By ensuring that new RT route alignments respond to existing areas of demand, and pass through less affluent areas, mobility can be dramatically improved for existing residents - particularly those without car access.

3.23 The provision of RT routes will also act as a catalyst for regeneration and development. This is likely to result in an increase in investment and spending along the RT network, which will provide additional services and opportunities to existing residents.

Reduced emissions and cleaner air

3.24 The provision of a high frequency, high quality RT network will help transition the city to a less car dependent future, which, alongside more active travel though an improved walking and cycling network, will deliver reductions in per capita CO_2 emissions.

3.25 This shift will also reduce the release of other damaging pollutants such as NO_x and particulates. The greater control that can be exerted over vehicle choice in a public transport fleet, particularly if access to infrastructure is managed and contingent on meeting agreed environmental standards, also means that emissions standards can be rigorously applied. For example, this might require the RT fleet to adopt EV technology.

Delivering High Quality Places

Active places by design

3.26 The Redways are under-utilised, perceived as unsafe and indirect, and not a sufficiently attractive alternative to the car. Andrew Gilligan, as part of his review on potential investment in cycling for the National Infrastructure Commission, highlighted these concerns and put the case for significant investment in the network including improved at grade crossings of the grid roads, surface level bypasses for those not crossing over or under, an east-west city centre route, improved maintenance and better promotion[16]. Addressing these points will be essential to growing cycling mode share. A RT network for MK could readily deliver direct cycle connections across the city, by including segregated cycle lanes adjacent to the RT lines, as has been delivered in Cambridge alongside the guided busway and in Nottingham next to some NET tram lines.

3.27 A key element of the RT strategy is to facilitate TOD, which is typically defined as "more compact development within easy walking distance of public transport stations or stops that contains a mix of activity-generating uses (housing, jobs, shops, restaurants/community and social facilities)"[17]. Delivering such places helps to reduce trip distances and puts a greater range of services within a reasonable walking and cycling distance. Designing high quality streets, alongside encouraging shorter trips to be undertaken by foot and on bike, results in a busier public realm promoting social interaction and improving safety.

[16] Andrew Gilligan, 2018: Running out of road: Investing in cycling in Cambridge, Milton Keynes and Oxford
[17] Chapter 7 of DLA's Milton Keynes Strategic Growth Study provides more detail on how TOD would form part of the growth proposed for the city

3.28 The opportunity to embed the ten NHS Healthy New Towns principles, will also help ensure the new communities are active by design.

Supporting higher density places within MK

3.29 A key principle of the RT network is that it facilitates high quality development, at higher density than has traditionally been the case in the city, with reduced car parking levels and where walking and cycling is given priority in the public realm. This will be achieved through providing a high frequency, direct and reliable RT network that provides residents with an alternative to car use that is more convenient than using the car. This would sit alongside a comprehensive walking and cycling network.

3.30 The provision of car parking at levels lower than traditionally seen in Milton Keynes is crucial to reducing car use, making more efficient use of land and therefore facilitating higher density development that generates substantial RT demand. Analysis undertaken for Transport for London (TfL) demonstrates that the availability of parking is a strong determinant in whether people choose to own a car or not, with car ownership 18% lower in developments with <0.5 spaces per dwelling. However, low parking provision alone isn't sufficient to reduce car ownership and good public transport must also be available. The TfL research found that car ownership is 10% (or more) lower in areas with higher PTAL levels[18].

3.31 In Vauban, an eco-district in Freiburg, residents can choose to own cars and can drop off and pick up at their homes, but they must park their cars in communal multi-storey car parks at the edge of the development. For this they pay a one-off purchase charge and a monthly maintenance charge. Households without cars are not subject to these charges and therefore do not subsidise the cost of parking provision. By comparison Rieselfeld, another eco-district in Freiburg, provided its car parking on-plot. The result is that car ownership is 42% lower in Vauban. Furthermore, the additional walk required to the car park reduces the convenience of car use, helping to reduce the relative time penalty otherwise experienced accessing transit stops and prevents cars from negatively impacting on public space. In Vauban there are designated *stellplatzfrei* streets (literally 'free from parking spaces'), which cars may travel on at walking speed for picking up and dropping off only[19].

[18] PTAL refers to Public Transport Accessibility Level, a measure of a location's proximity to public transport. See: http://content.tfl.gov.uk/residential-parking-provision-new-development.pdf

[19] Andrea Broaddus. 2010. Tale of Two Ecosuburbs in Freiburg, Germany: Encouraging Transit and Bicycle Use by Restricting Parking Provision. *Transportation Research Record: Journal of the Transportation Research Board.* No. 2187, pp. 114–122.

3.32 While cars would be able to access individual properties or car parks in new development via the strategic road network, it is anticipated that the street network would not allow car travel across new developments. This builds on best practice in the Netherlands and elsewhere where such principles of 'filtered permeability' have been successfully employed for decades, achieving the high walking, cycling and public transport mode share seen there.

3.33 There are specific opportunities within Central MK, including a new University, densification of commercial buildings and re-purposing of existing car parking into more productive land uses. These opportunities will help to drive footfall and create a more vibrant city centre.

3.34 At RT nodes there is the potential to achieve higher density development at selected locations across the city. These include new growth locations, existing transport nodes and along the grid roads (some of which are explored in more detail in Part 3 of DLA's Milton Keynes Strategic Growth Study). Currently public transport stops on the grid roads are often isolated and remote from the built-up areas within the grid squares. With the provision of high frequency RT services these will become some of the most accessible locations in the city and therefore there is significant potential to create new development nodes that will start to knit the grid squares together at specific locations, helping to reduce the severance effect of the grid roads.

3.35 It should be noted that in order to ensure a robust case is presented with regards to RT demand assumptions and viability, the potential additional housing and commercial space provided through densification at nodes has not been factored into the operational and financial feasibility work set out in Section 5.

Supporting Renaissance MK

3.36 One of the five core projects set out in the MK50 Futures Report relates to Renaissance MK, which focuses on improving the quality and vitality of CMK. With almost 50ha of land to be developed within CMK[20], including MK:U and 5,000 new homes allocated within Plan:MK, there is significant potential for CMK. However, the problems of car domination and congestion, and the brake this will apply to growth and to the quality of the environment, is likely to be felt most keenly here in a 'more of the same' scenario. By making more efficient use of space, a RT system will facilitate the increased demand for travel anticipated to 2050 (as illustrated in Figure 2-10) and allow CMK to continue to function without levels of congestion that will otherwise stifle growth.

[20] MK50 Futures Report, p48

3.37 RT allows wider benefits to be achieved from Renaissance MK. Carriageway space can be released for other uses, including improved public realm and improved interchange facilities, and substantial quantities of car parking could be re-purposed with new land uses that in themselves will generate new activity.

4. RT:MK – a proposed network

Key principles

4.1 A number of key principles have been adopted to help inform the development of a RT network for Milton Keynes, to ensure it is attractive to use, and to facilitate the delivery of 'good growth'. As set out in Table 4-1, they were prepared in advance of our work on concept design and scoping of possible route/vehicle/service pattern options.

Table 4-1: Key RT principles for MK

Key Principle	Description	Mobility Opportunity Satisfied
Integrated	RT offers flexible, high frequency, high capacity trunk network role, supported by integrated network of shared transport services and high-quality walking and cycling infrastructure	Integration across modes / Inclusive alternative to car / Responding to future changes / Mobility for all
Competitive	RT routes generally follow grid roads, allowing for fast, direct routes with fewer stops in comparison to local buses (every ~850m) enabling quicker journeys than are possible by car	Inclusive alternative to car / Future proofing journey times / Mobility for all
Reliable	Around 90% of the network is segregated, either in grid roads or new development sites, allowing for reliable journey times, complimented by a high degree of priority at junctions	Inclusive alternative to car / Future proofing journey times

Key Principle	Description	Mobility Opportunity Satisfied
Delivering Transit Oriented Development	Facilitates high-quality, higher density development with reduced parking levels and priority for walking and cycling. The street network in new developments will favour RT, walking and cycling options over those by car	Active Places by Design / Supporting High Density Places
Delivering Mobility Hubs	Many RT stops will be mobility hubs, providing access to a range of services such as drop-off for on-demand services, cycle hire and parking, car clubs, click & collect, and convenience retail	Integration Across Modes
Flexible	The RT network must allow for flexible use in future to accommodate changes in technology, as well as potentially allowing shared use of the network at off-peak times, for example for freight delivery, shared vehicles, CAVs etc.	Inclusive Alternative to Car / Future Proofing Journey Times

Joining the city together

4.2 The proposed RT network has been developed in parallel with the spatial growth work being led by DLA and is show in Figure 4-1. It is informed by our analysis of existing and future movement patterns (presented in Section 2) which we have reiterated for each RT line in Table 4-2.

4.3 The network is based on the all mode travel demand generated across the city and maps to the corridors of highest demand as forecast in 2031 and 2050. Despite Milton Keynes being conceived as a poly-centric city, in practice the most significant movements are those that originate outside the centre and travel into it (see Figure 2-5Figure 2-6Figure 2-7). This reflects the density of jobs within CMK and its anticipated growth as an employment destination in the future. However, the RT network is not conceived as a radial network where all passengers are required to change in the centre, but rather one where cross-city routes would be provided making use of the corridors identified in Figure 4-1, which will be developed based on additional demand analysis.

4.4 The network links existing key destinations and trip generators, along with new TOD that will be delivered in proposed growth locations. Crucially, these new developments will be designed around the RT lines with RT infrastructure embedded seamlessly into the public realm from the outset. The network also reaches outside Milton Keynes and connects with potential new communities in AVDC, such as at Winslow and Newton Longville, as well as offering the opportunity to extend lines to connect growth areas such as Cranfield and Ridgmont. In the longer term opportunities could be explored to connect locations further from the city, for example Marston Mortaine (Line 5), Olney (Line 6) and Towcester (Line 8). The key drivers of demand are shown spatially in Figure 4-3.

4.5 The close and collaborative working with DLA has ensured that the location and form of development[21] is not only conducive to being served by RT but also that development can be used as a way of driving demand for RT routes that can then bring benefits to the existing city. This includes providing higher density development with RT infrastructure embedded seamlessly into the public realm. Our view is that RT must sit front and centre of the approach to placemaking and will suggest where growth should be located.

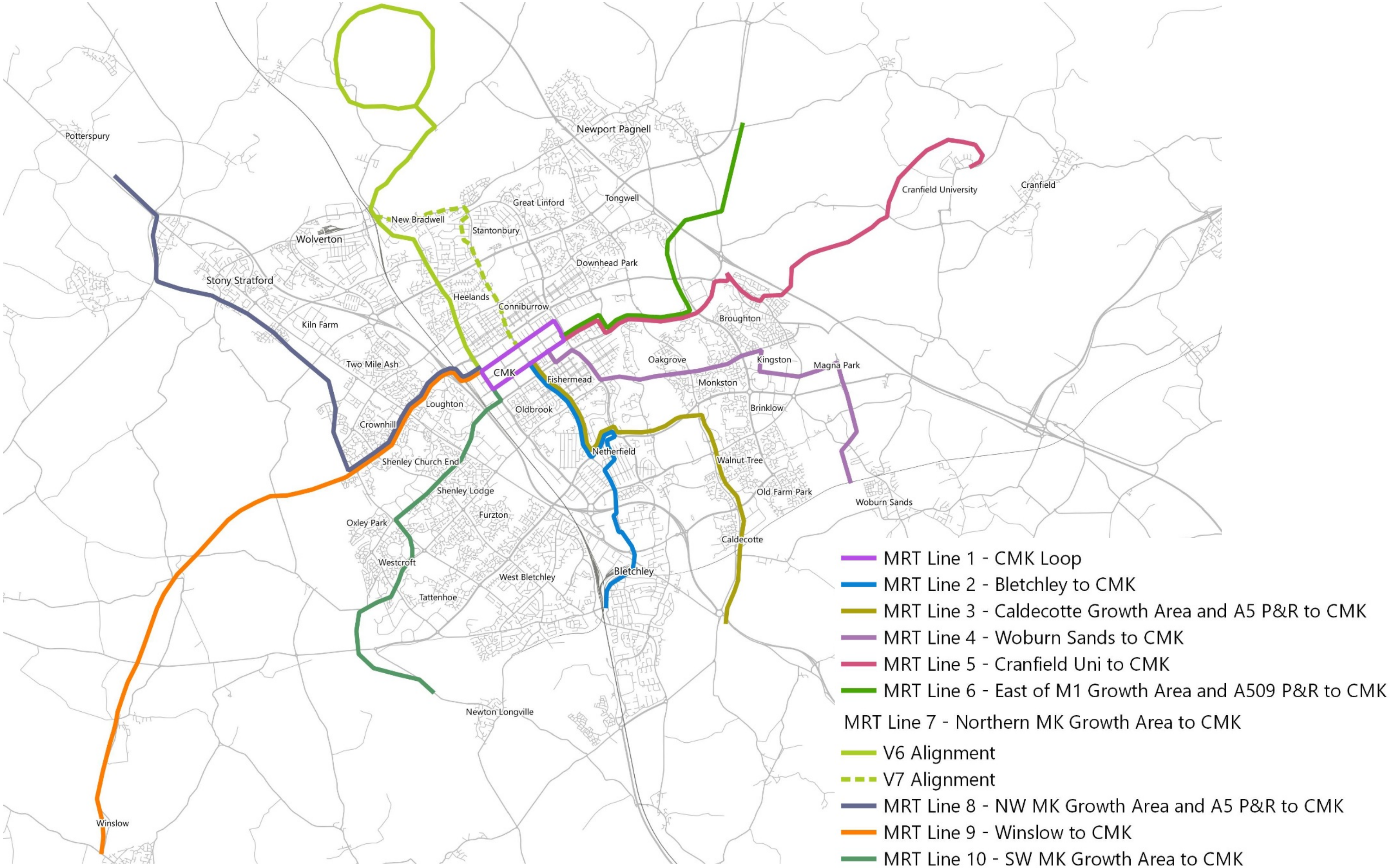
4.6 The proposed full 2050 network is described in Table 4-2 and shown in Figure 4-1.

[21] A series of spatial typologies have been developed by DLA as part of the Strategic Growth Study. These include Completing the Grid, Rail-Based Transit Growth, New TOD Communities and Intensification and Regeneration.

Table 4-2: Proposed RT route descriptions

Line	Description
Line 1: CMK loop	Serves growing employment and residential demand in CMK
Line 2: Bletchley to CMK	Serves regeneration of CMK and V7 corridor as well as key trip generators as the stadium and hospital
Line 3: Caldecotte Growth Area and A5 P&R to CMK	Serves Plan:MK allocated growth as well as the Open University campus and hospital and potential A5 P&R
Line 4: Woburn Sands to CMK	Serves Plan:MK allocated growth as well as Kingston, Magna Park, a proposed new E-W station and new community
Line 5: Cranfield Uni to CMK	Serves Cranfield Uni and new communities surrounding it, Plan:MK allocations and new communities E of M1 and the existing J14 P&R
Line 6: East of M1 Growth Area and P&R to CMK	Serves Plan:MK allocated growth as well as new communities east of Newport Pagnell and a potential A509 P&R.
Line 7: Northern MK Growth Area to CMK	Serves a new community to the north of the city as well as Hanslope Park and potential regeneration sites along V6 and V7
Line 8: NW MK Growth Area and A5 P&R to CMK	Serves Plan:MK allocated growth, a new community to the NW of the city and development along Portway and potential A5 P&R
Line 9: Winslow to CMK	Serves new communities in AVDC from Winslow, including a potential E-W station at Winslow
Line 10: SW MK Growth Area to CMK	Serves Plan:MK allocated growth, new communities around Newton Longville, regeneration at West Croft and a potential A421 P&R

Figure 4-1: Proposed 2050 RT network



4.7 As well as setting out spatially the key drivers of demand, Figure 4-3 also shows indicatively how local mobility services could provide feeder routes that support the trunk network of high frequency, high capacity RT services and responds to 'first/last mile' demand. These underlying services are crucial to the success of the RT network in lower density locations in Milton Keynes (many of the existing communities), as they will significantly extend RT catchments. Such local mobility services could include:

- Electric cycle hire (with an improved cycle network)
- Local buses
- On-demand taxi and bus services
- Car club
- Autonomous pods and shuttles

4.8 To ensure the user experience is seamless and flexible, and therefore attractive as an alternative to the car, the various mobility options will ideally be integrated into a MaaS platform. This will allow users to make better-informed, more flexible choices about the mobility options on offer based on journey time, interchange, cost and convenience considerations.

4.9 This approach of delivering a high capacity, high frequency, trunk network supported by a range of local buses and other services is common in cities across the UK and Europe. For the NET tram network in Nottingham serves only a relatively limited area of the city, but is supported by bus services.

4.10 As well as offering a high degree of segregation for RT services, the network is likely to have spare off-peak capacity that could be made available for alternative uses. This might include connecting a network of urban consolidation centres[22] across the city and allowing freight vehicles to use the network and therefore benefit from quicker and more reliable journey times. The network could also be made available to autonomous or other shared mobility options. Access to the network for non-RT vehicles could be during fixed hours or, making use of interoperable technologies and connected vehicles, could dynamically respond to periods when spare capacity exists.

4.11 Through charging an access fee such alternative uses could provide an additional revenue stream, helping to supplement the financial viability of the network (NB: the scoping and outline feasibility work undertaken by ITP has not factored-in this additional revenue, so the RT proposals envisioned do not rely on it in any way). Figure 4-4 illustrates how the RT network could integrate with other travel modes and options

[22] Urban consolidation centres are warehouses, usually edge of centre, that receive freight from larger vehicles and consolidate into more efficient loads for 'last mile' delivery on more suitable modes, such as electric van or cargo bikes

in MK as they evolve. These should ideally come together as part of a holistic MaaS offer, which transforms urban mobility for residents, visitors and employees in Milton Keynes.

Figure 4-2: The tram network in Nottingham (top) is supported by local bus services (bottom)

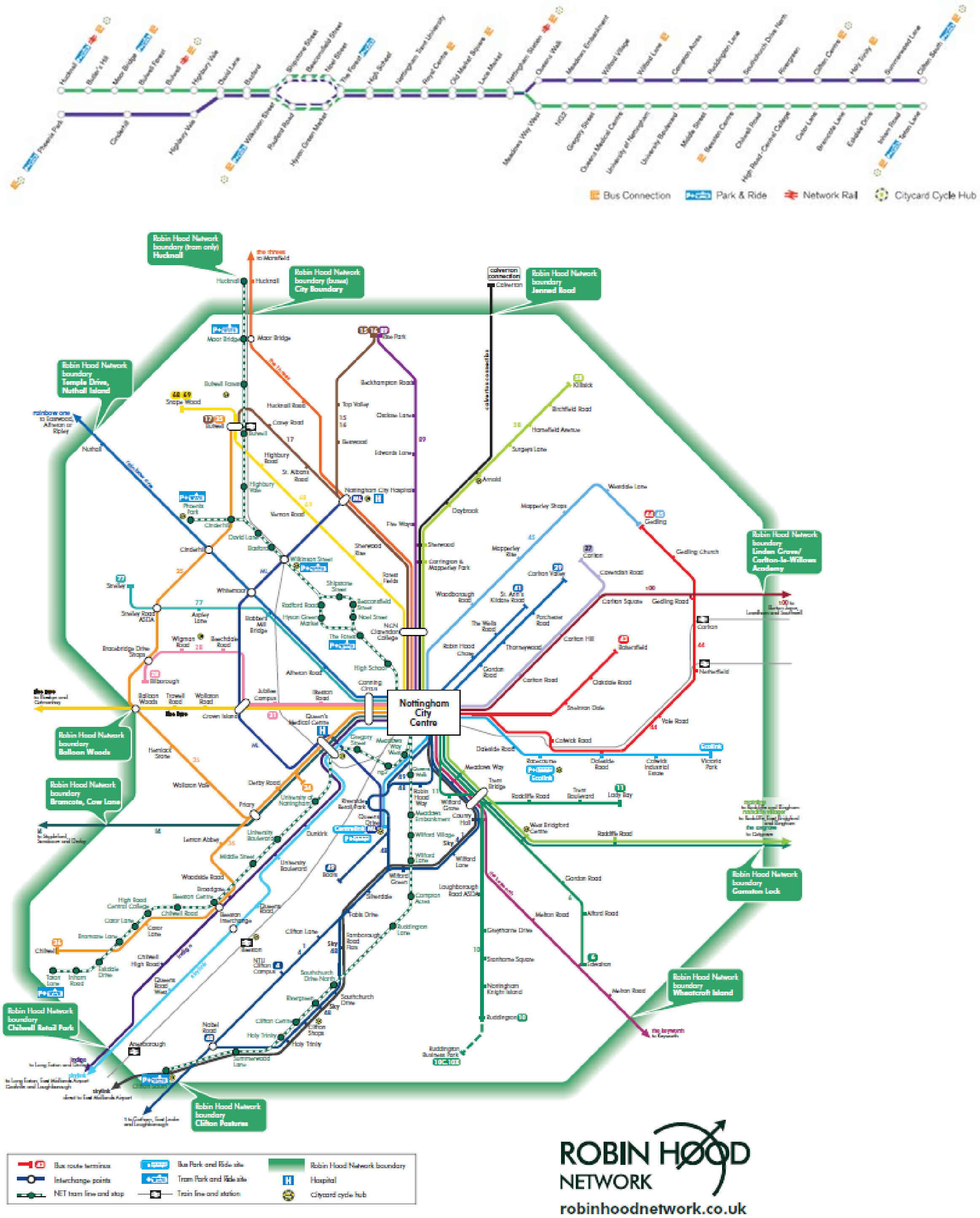


Figure 4-3: Proposed 2050 RT network with existing demand, Plan:MK growth and new communities shown

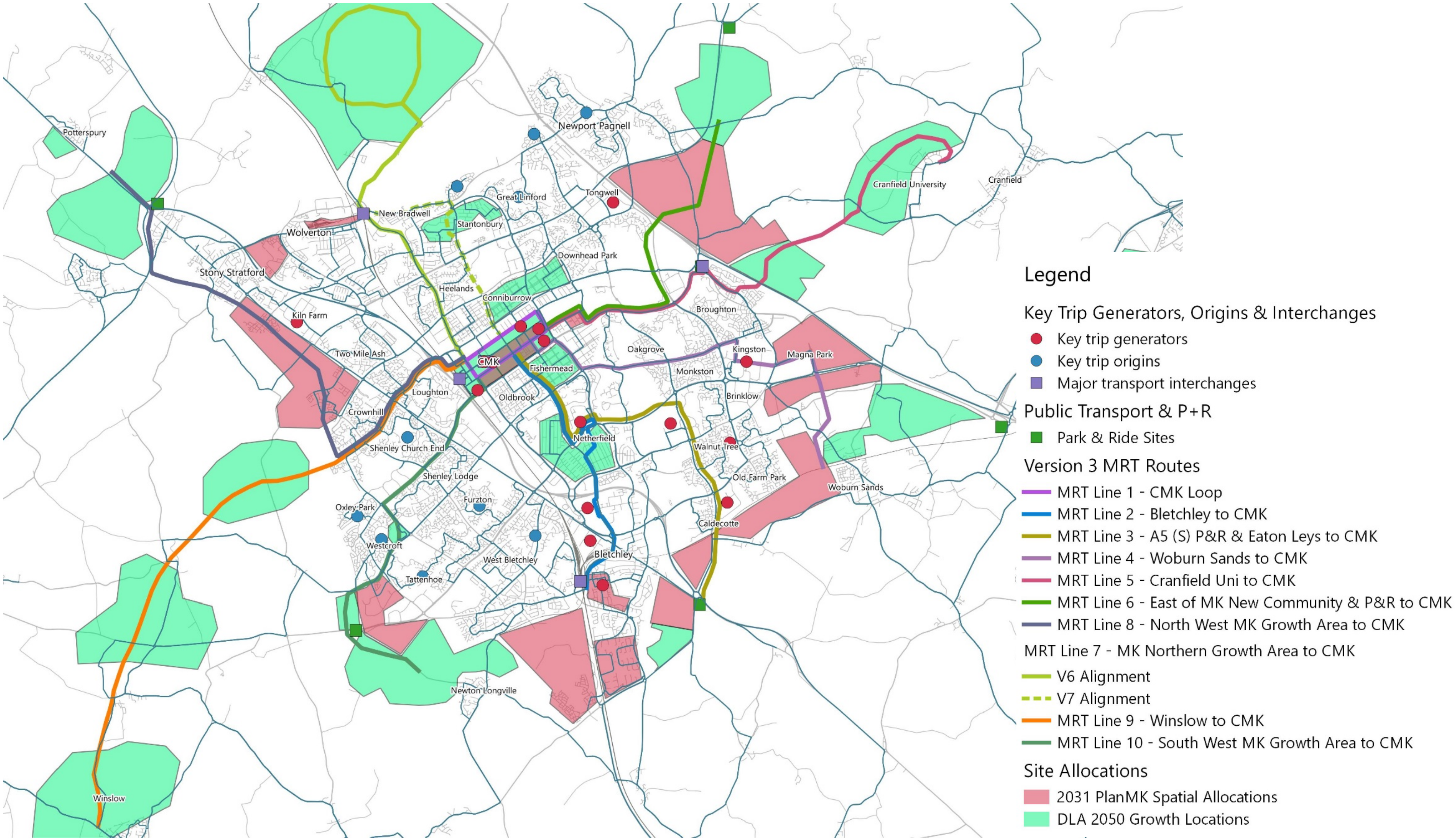
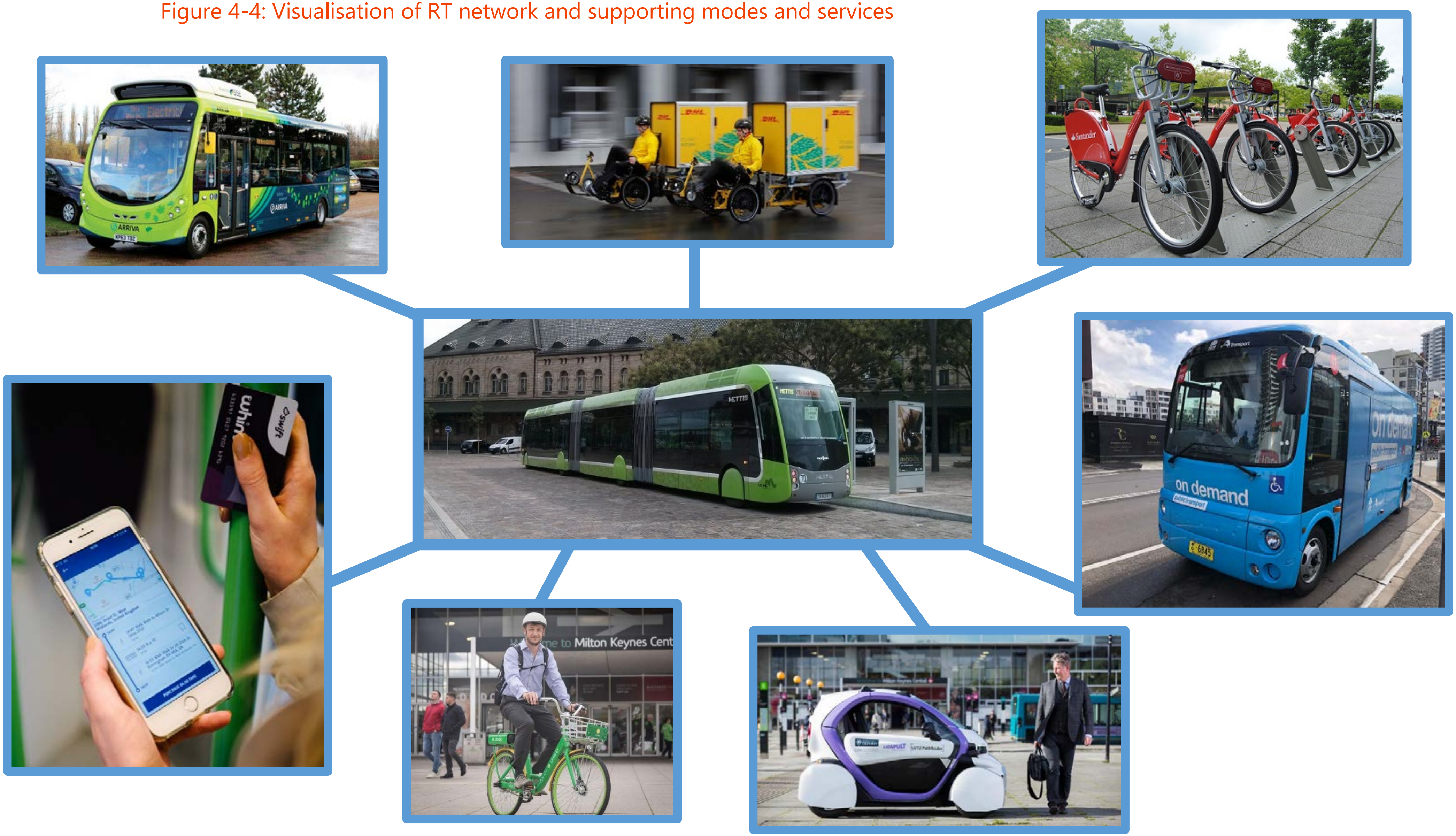


Figure 4-4: Visualisation of RT network and supporting modes and services



RT mode options

4.12 Two broad types of vehicle have been considered through the process of envisaging RT for MK; high-quality rubber tyred vehicles (RTV) and a tram. In order to provide evidenced assumptions on capacity and cost, delivered rapid transit systems (with data on costs and mode-share impacts) were reviewed. For RTV two levels of service have been considered based on Bus Rapid Transit (BRT) precedents. These are BRT 'light', as operated in Helsinki (Figure 4-5), and full BRT as operated in Nantes (Figure 4-6). For the tram, Nottingham has been used as a precedent (Figure 4-7).

Figure 4-5: Helsinki BRT light

Source: Flickr - Timo-Pekka Heima

Figure 4-6: Nantes BRT

Source: COST

Figure 4-7: Nottingham tram

Source: QMP

4.13 The core characteristics, capacity and costs for each mode options are described in Table 4-3. The costs of constructing a tram network is around four times that of an equivalent RTV / BRT network. This relates primarily to the additional requirements of track and catenary infrastructure and the extensive utility diversions that are often required in constructing tramways.

Table 4-3: Rapid Transit precedents

	BRT 'light' (Helsinki)	BRT (Nantes)	Tram (Nottingham)
Infrastructure	Some segregated running, priority at junctions	Substantial segregated running, priority at junctions	Some mixed running but significant dedicated trackway
Vehicles	Standard single deck buses	High quality, articulated vehicles	Articulated tram
Infrastructure cost	£2,250,000 per km	£7,580,000 per km	£28,000,000 per km
Vehicle cost	£150,000 per vehicle	£800,000 per vehicle	£2,800,000 per vehicle

4.14 There are two perceived benefits of operating a tram network over RTV. Firstly, tram allows higher capacity services to be run with fewer vehicles, due to the larger vehicles. This might provide operational cost savings where vehicles of 200+ capacity are used. However, experience from RTV schemes across the world including in Latin America, Turkey and China demonstrate that the overall capacity of RTV networks can be very high, up to twice that of tram or light rail[23]. In Milton Keynes the level of passenger demand generated, even by 2050, is highly unlikely to be sufficient to warrant investment in a tram network.

4.15 Secondly, tram is often perceived to be a higher quality offer in comparison to bus based forms of RT, and therefore more effective at bringing about mode shift. However, there is little evidence to show that tram-based networks encourage greater mode shift from car than do bus based schemes. Recent research for the DfT investigating diversion factors (i.e. the impact of changes on one mode on the demand for other modes) found that the diversion factors from car were slightly higher for bus schemes than for light rail[24]. 'Trackless tram' or rubber-tyred tram technology is being developed that makes use of optical guidance systems rather than tracks, battery powered electrical operation rather than overhead catenary and high-quality rubber-tyred vehicles using bogeys (see Figure 4-8).

[23] ITDP, 2017: The BRT Planning Guide. P52
[24] RAND and SYSTRA, 2018: Bus fare and journey time elasticities and diversion factors for all modes

Figure 4-8: Trackless Tram in operation in Zhuzhou, China

Source top: Nicolas Zart

Source bottom: Peter Newman

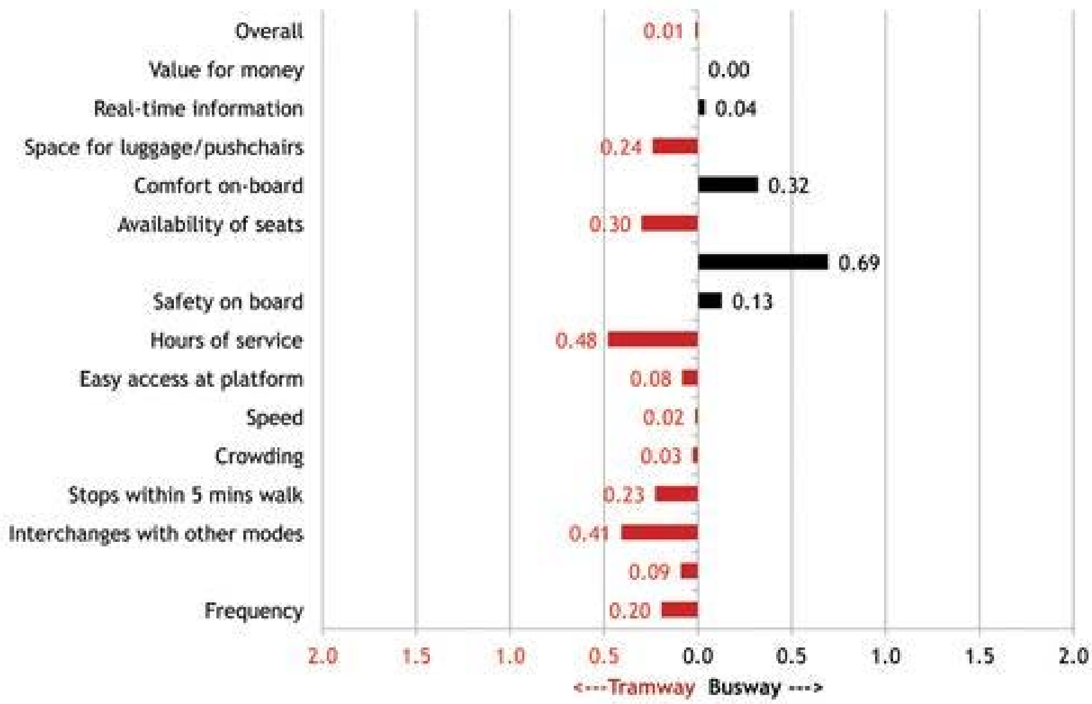
4.16 Taken together this technology offers many of the benefits of tram operation in terms of high capacity, high-quality vehicles but with the lower cost and flexibility of a bus-based system. The technology is being developed and trialled in China, with expressions of interest in the technology in Perth, Australia and Miami, USA.

4.17 Meanwhile some RTV schemes in the UK have also been highly successful at securing positive mode shift from car. Fastway, a guided bus scheme in Crawley, increased its patronage by 160% over ten years and facilitated a 19% decrease in traffic levels between 2006 and 2013.[25] Between the 2001 and 2011 Census bus use in Crawley for travel to work increased by 30%[26]. Studies in relation to the Cambridgeshire guided busway suggest that for developments within its catchment car mode share is 30% lower than comparable schemes outside the catchment[27].

[25] https://greenerjourneys.com/wp-content/uploads/2015/09/Ex-Post-Evaluation-of-Bus-Infrastructure-150908-v-STC-FINAL.pdf
[26] Census Travel to Work data 2001 and 2011
[27] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4496849/

4.18 In Nantes where they operate both a BRT and tram network, a user satisfaction survey found only a very marginal overall difference between the two networks, with a slight preference towards BRT (Figure 4-9)[28].

Figure 4-9: Nantes trams and BRT user satisfaction survey results



Source: Steer

4.19 The evidence above suggests that if RTV is built with the same levels of priority as would be expected for a tram network then the outcomes, in terms of mode shift from car and user satisfaction, can be comparable. The costs of delivering a RTV and tram variant of the RT network illustrated in Figure 4-1 have been developed in order to allow comparison.

Route typologies

4.20 To determine infrastructure cost and journey time, each section of route has been classified into one of five types (Table 4-4). Each route type has a cost associated, based on precedents from elsewhere, including the figures from Table 4-2. For each type of route an anticipated vehicle running speed has been assumed and this, along with stop dwell time, determines journey time (see Section 6).

[28] https://www.transportxtra.com/publications/local-transport-today/supplements/531/35633/do-passengers-prefer-brt-or-lrt-/

Table 4-4: Route type, including running speed and cost per km

Route type	Description	Running speed	Cost (per km)
Priority running in traffic	RT vehicles run within mixed traffic but with measures such as dedicated lanes and signal priority at junctions	30kph	£1,875,000[29]
Place focused	RT vehicles have a dedicated alignment within a landscaped public realm in new developments	30kph	£7,580,000[31]
Grid road (in carriageway)	RT vehicles run within dedicated lanes adjoining or within the existing carriageway	70kph	£3,750,000[30]
Segregated	RT vehicles have a dedicated alignment between Milton Keynes and adjoining settlements or new growth locations	55kph	£7,580,000[31]
Grid road (new carriageway)	RT vehicles run in dedicated lanes along a new alignment within the existing highway boundary but separate from the existing carriageway	70kph	£7,580,000[31]

4.21 The route network by route type is shown in Figure 4-13 along with precedents. In total around 90% of the network is segregated allowing for reliable journey times, which will be crucial as congestion grows to 2050.

4.22 As well as providing a high degree of segregation along links, a key principle of the network must be that RT is afforded priority through junctions. This will be essential in order to maintain journey times and reliability on an increasingly congested network. As the majority of lines will run for at least part of their route along the grid road corridor, the existing roundabouts will require retrofitting in order to provide priority to RT. A range of junction design measures will need to be developed drawing on best practice from the UK and Europe. These will include signal-controlled RT gates, dedicated RT lanes running through the central island (the 'hamburger' approach) and conversion of roundabouts to signalised cross roads.

4.23 Bus gates are relatively commonly used in the UK, with examples in London, Crawley (Fastway) and Kent (Fastrack) (see Figure 4-10). For larger junctions, the priority

[29] Greener Journeys, 2014: A National Statement on Local Bus Infrastructure Executive Summary. Taken from range of figures from £150,000 per km for basic bus lanes to £4.8m per km for extensive dedicated running
[30] Based on costings from Nantes BRT reduced to reflect the fact that the route type is using existing carriageway
[31] Based on costings for Nantes BRT taken from https://brt.fareast.mobi/en/cities/nantes.aspx accessed 04/07/2018

'hamburger' approach would be appropriate and has been used in Crawley (Fastway) (see Figure 4-11) with more common use as a means of providing priority for dominant traffic movements for general traffic. For roundabouts with smaller inscribed circle diameters or where there is ample spare capacity, non-signalised approaches could be considered as are used along the BRT network in Nantes (see Figure 4-12). These would give priority to RT through use of give way markings.

4.24 Segregated cycle routes would need to be designed into these schemes.

Figure 4-10: Bus gate in Northfleet, Kent

Source: Google

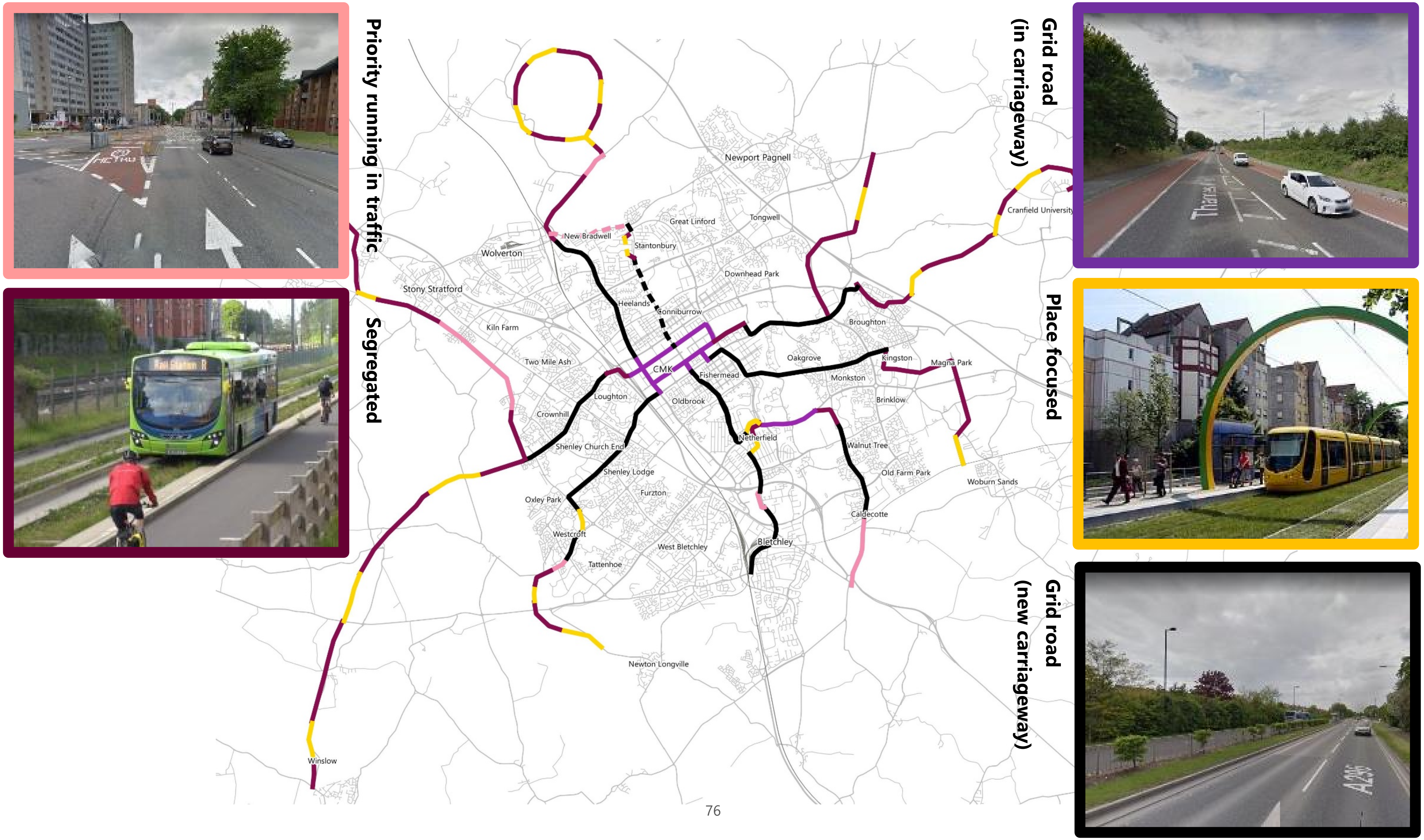
Figure 4-11: 'Hamburger' signalised roundabout junction in Crawley

Source: Google

Figure 4-12: 'Hamburger' non-signalised roundabout junction in Nantes

Source: Google

Figure 4-13: Route types and precedents



5. Operational and financial feasibility

Key Assumptions

5.1 In order to determine the operational characteristics of the RT network and therefore its capital and revenue costs, a series of core assumptions have been made (Table 5-1).

Table 5-1: Core RT network assumptions

Assumption	Description
High Frequency Services	Minimum service headway of nine minutes. Along with vehicle carrying capacity, frequency determines the capacity of the line. Capacity must relate to demand in order to remove need for significant public subsidy.
Route type and Assumed Vehicle Speeds	Five route types have been defined with anticipated vehicle running speed (see Table 4-4). Applying an assumed running speed to each route type, alongside a stop dwell time of 30 seconds for each stop, allows journey time to be estimated.
Capital and Operating Cost and Revenue	High level cost estimates have been prepared for the proposed RT routes based on per km and vehicle costs from RT schemes in the UK and elsewhere (see Table 4-4). Operating costs are based on the annual operating cost of vehicles by TfL, with an uplift factor applied for trams. A ticket cost of £2 per journey has been assumed.
Future Demand Scenarios	To establish future demand on the RT network low (6%), medium (15%) and high (29%) demand scenarios have been established. The low scenario is based on the existing MK bus mode split (see Table 2-3), 15% based on BRT light in Helsinki[32] and 29% based on public transport in Nottingham[33].
Park and Ride	Based on the potential park and ride (P&R) sites identified in MKC's Mobility Strategy, alongside an analysis of the distribution of trips into the city based on the MKMMM, five P&R locations have been included within the assessment. The P&R sites generate demand that helps the viability, as well as easing congestion within the city.

[32] Public transport represents 30% of all trips (https://www2.deloitte.com/content/dam/insights/us/articles/4331_Deloitte-City-Mobility-Index/city-mobility-index_HELSINKI_FINAL.pdf, accessed 04/07/18) with 50% by bus (2015 HSL Helsinki Region Transport Annual Report, 52)

[33] 2011 Census QS701EW - Method of travel to work MSOA E02002884 and E02002885

Growth Beyond 2031	85% of new residential development post 2031 assumed to be served by RT. This will require higher densities than traditionally delivered in MK (TOD). Only residential trips have been assessed.

Park and ride

5.2 As noted in the Mobility Strategy, the largest component of forecast traffic growth to 2031 is from vehicles originating outside Milton Keynes. Intercepting these trips before they reach the centre of the city has multiple benefits, which includes reducing the growth of traffic within the city and especially the city centre and reducing congestion on the highway network and therefore reducing the need for costly highway interventions. P&R will be an important element in intercepting these trips and has the potential to generate a significant amount of demand that can help drive the viability of RT.

5.3 The potential P&R sites included within the assessment are set out below:

- South (A4146 / A5 junction) – 550 spaces in 2031 and 800 in 2050
- South west (A421 / Standing Way) – 300 spaces in 2031 and 500 in 2050
- North west (A5 / A508) – 400 spaces in 2031 and 625 in 2050
- North east (A509 / A422) – 500 spaces in 2031 and 700 in 2050
- East (existing M1 J14) – 600 spaces in 2031 and 900 in 2050

5.4 The size of the P&Rs has been estimated by applying an intercept rate[34] for vehicles on the adjacent road network adjusted to reflect the volume of vehicles estimated to be entering Milton Keynes from each main approach to the city taken from analysis of the MKMMM outputs. In practice the P&R sites could be designed and constructed to a larger size, thereby allowing for future growth, but the numbers above are based on forecast demand.

Housing demand

5.5 The MKMMM includes all growth allocated within Plan:MK, which amounts to around 26,000 additional homes by 2031. Based on discussions with MKC and DLA the 'transformational' growth aspiration generates a housing delivery rate of around 3,000 homes per year. It is therefore assumed that there will be some additional delivery of housing, in addition to the Plan:MK allocations up to 2031, although the majority of new housing planned as part of this growth study will be delivered post 2031.

[34] Intercept rate taken from review of intercept rates from the 2010 report Nexus Park and Ride Strategy, p17

Assuming a delivery rate of 3,000 homes per year on average up to 2031 17% of the housing defined in the growth study could be delivered up to 2031 with 83% following up to 2050. This split of housing has been assumed in the 2031 and 2050 demand scenarios as set out in Table 5-4.

5.6 In order to determine trip rates for the new housing, we interrogated TRICS - a national database of trip rates based on surveys at completed developments. The selection criteria and subsequent trip rate are set out in Table 5-2 and Table 5-3 respectively.

Table 5-2: TRICS selection criteria (residential - mixed private and affordable)

Criterion	Requirement
Regions	England, excluding London
Number of dwellings	Any
Date range	01/01/10 to current
Week days to include	Tuesday to Thursday
Location types	Suburban, edge of town
Population < 5 miles	25,001 to 125,000
Car ownership	Up to 1.5
Miscellaneous	Over 50dph

Table 5-3: Residential trip rates

Time range	Arrivals	Departures	Totals
08:00-09:00	0.18	0.809	0.989
17:00-18:00	0.558	0.311	0.869
Daily Trip Rates:	3.711	3.974	7.685

5.7 As described in Table 5-1 no trips have been added to the network for the employment uses for the new communities. In practice these will be mixed use developments that will include significant new employment and other trip attracting uses, in addition to residential demand.

Demand forecasts

5.8 Demand for RT has been forecast in order to identify potential revenue and therefore future viability of the network. Demand has been forecast for 2016, 2031 and 2050 and the elements included in each scenario are set out in Table 5-4.

Table 5-4: Demand assumed for each scenarios

Assessment year	Demand included
2016	2016 MKMMM OD outputs (baseline)
2031	2031 MKMMM OD outputs (Plan:MK and background growth from 2016) + 2031 P&R demand + additional housing to 2031 (17% of growth study housing) + MKU + growth at Cranfield Uni (25% assumed)
2050	2031 MKMMM OD outputs + 2050 P&R demand + additional housing to 2031 (100% of growth study housing) + MKU + growth at Cranfield Uni (100%)

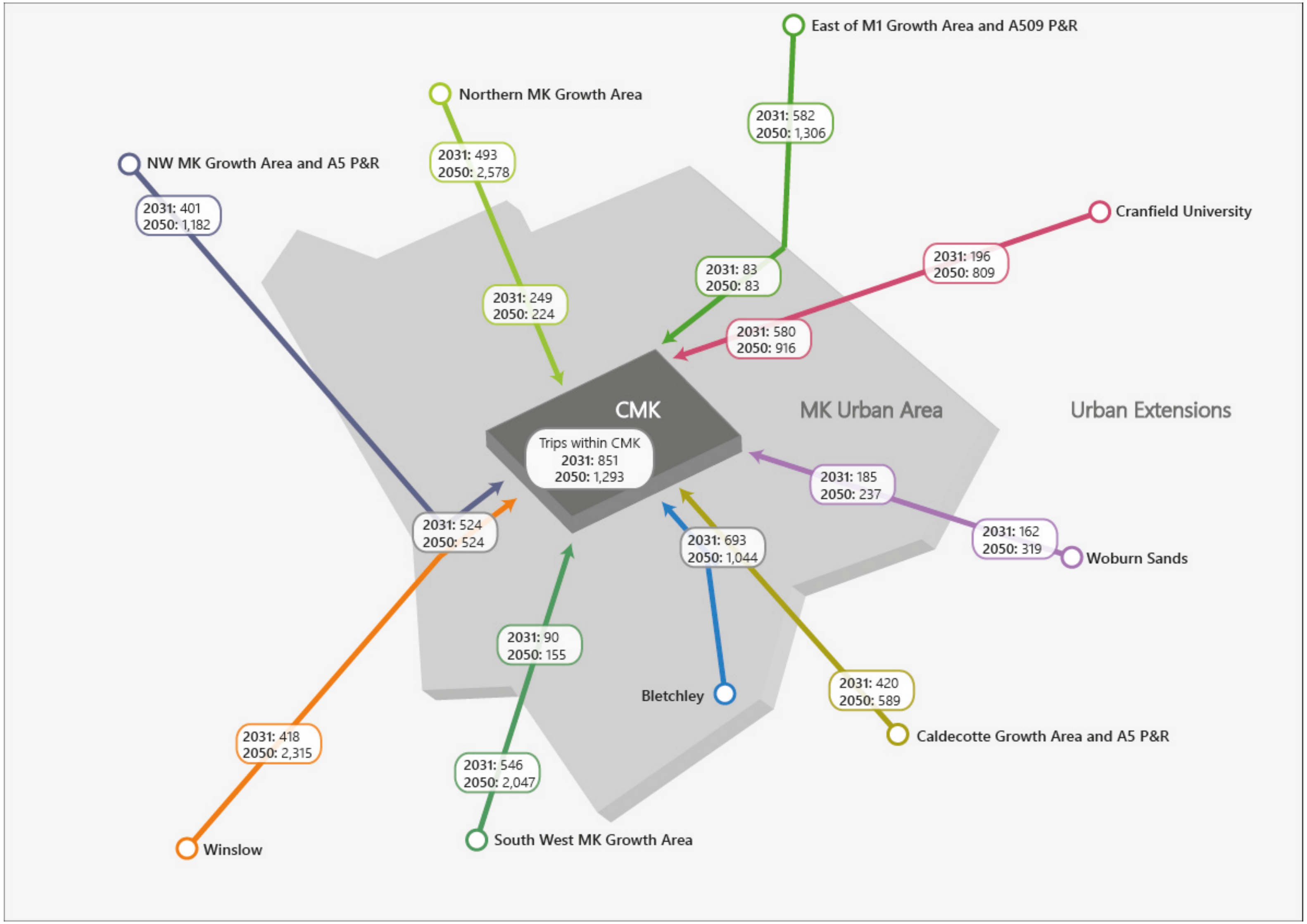
5.9 The demand derived from each element set out above has then been coded into the MKMMM SATURN zones in order to place it spatially within the city and allow Origin - Destination (OD) movements to be established. To determine demand by line the RT routes in Figure 4-1 have been drawn in GIS, enabling catchment demand analysis. A 500m buffer has been drawn either side of each line and all zones fully contained within the buffer or intersecting it significantly were selected as being part of the line's catchment. All trips that have both an origin and destination within the buffer have been extracted and used to determine the potential demand for each line.

5.10 The RT routes all serve Milton Keynes Central station. Across the network, and particularly within CMK, there are areas where the line catchments overlap. To overcome this issue, where zones fall within the catchments of multiple lines, the trip rate figure for that zone has been divided by the number of lines within the same catchment in order to ensure no double counting of trips.

5.11 The total AM peak hour demand (based on both origins and destinations) is shown spatially, by RT line, in Figure 5-1: . In order to calculate annual demand from the AM peak figures two factors have been applied. A peak hour factor of 2.81 has been applied in order to establish daily (i.e. AM, PM and interpeak) demand based on work completed for the Plan:MK evidence base[35]. An annualisation factor of 300 has then been applied to get from daily trips to an annual figure.

[35] AECOM, Milton Keynes Multi-Modal Model, Impacts of Plan:MK, p41 Table 15

Figure 5-1: AM peak hour demand by line



Network view

Network summary

5.12 Table 5-5 and Table 5-6 summarise the key network performance statistics for 2031 and 2050 for RTV and tram respectively. The outputs are based on the demand assumptions set out in Table 5-4 and the medium demand scenario of a 15% RT mode share and show that:

- The overall capital cost of a RTV network is around £1.1bn.
- The overall capital cost of a tram network is around £4.5bn.
- The annual demand within the network is 5.5m trips by 2031 and 13.2m trips by 2050.
- The annual RTV operating cost, based on peak vehicle requirement plus 10%, is £13.6m per year.
- The annual tram operating cost, based on peak vehicle requirement plus 10%, is £22.4m per year.
- Annual revenue, based on forecast demand, would cover 80% of the RTV network operating costs by 2031 and 49% of a tram network. At this level of cost recovery for RTV the network would require some public subsidy, which may be considered appropriate in the initial stages of operation. Moreover, operating costs may be adjusted by amending service headway to more closely match demand and additional revenue may be generated from other sources, such as 'pump priming' from development secured by planning obligation, advertising and non RT access charges.
- In 2031 Lines 3 and 6 would be the most profitable, reflecting the potential additional demand generated by P&R and the large amount of new housing planned within their catchments.
- By 2050 annual revenue would exceed operating costs by 93% for a RTV network and 18% for tram, with revenue exceeding operating costs by over 150% for some lines. In practice profits of this scale would not be realised as service frequency, and therefore cost, would increase with demand (as discussed in the next section).
- Those lines that have the greatest number of new homes and serve a P&R site are the most viable. This reflects the low-density nature of Milton Keynes and indicates that development should be phased along RT corridors in order to build demand.

- Cross-subsidisation of lines may be necessary, particularly in 2031, in order to deliver a network. For example Line 2 from Bletchley returns a relatively low return due to the limited amount of new housing along its route in comparison to other lines, however there is a strong case for delivering it early as it will provide a catalyst for regeneration and will improve mobility in some of the more deprived areas along its route.
- Line 1 is shown as recovering only 54% of its costs through operating revenue by 2031. However, demand within CMK has been distributed across all ten lines serving the area but if fewer lines are implemented, the proportion of trips carried by Line 1 would be higher (see discussion around phasing in Section 7).

Table 5-5: Network Summary (RTV)

Route	Capital Cost	Operating Cost	Annual Demand		Annual Revenue		Annual Cost Recovery	
			2031	2050	2031	2050	2031	2050
Line 1: CMK loop	£33,324,500	£924,000	251,762	692,908	£503,525	£1,385,816	54%	150%
Line 2: Bletchley to CMK	£94,082,351	£1,155,000	357,549	384,018	£715,098	£768,035	62%	66%
Line 3: Caldecotte to CMK	£96,012,408	£1,155,000	705,350	1,117,468	£1,410,701	£2,234,936	122%	194%
Line 4: Woburn Sands to CMK	£127,410,063	£1,155,000	361,329	537,787	£722,657	£1,075,574	63%	93%
Line 5: Cranfield Uni to CMK	£157,169,066	£1,617,000	708,218	1,507,926	£1,416,437	£3,015,852	88%	187%
Line 6: East of M1 to CMK	£111,039,492	£1,155,000	612,517	1,222,836	£1,225,035	£2,445,671	106%	212%
Line 7: Northern MK Growth Area to CMK	£175,671,691	£1,848,000	721,851	2,388,997	£1,443,703	£4,777,994	78%	259%
Line 8: NW MK Growth Area and P&R to CMK	£133,925,414	£1,617,000	530,194	1,188,675	£1,060,389	£2,377,349	66%	147%
Line 9: Winslow to CMK	£183,277,396	£1,617,000	652,035	2,251,188	£1,304,069	£4,502,376	81%	278%
Line 10: SW MK Growth Area to CMK	£111,858,594	£1,386,000	555,721	1,875,936	£1,111,443	£3,751,871	80%	271%
Total	£1,101,932,701*	£13,629,000	5,456,528	13,167,738	£10,913,056	£26,335,476	80%	193%

*total takes into account shared sections of route

Table 5-6: Network Summary (tram)

Route	Capital Cost	Operating Cost	Annual Demand		Annual Revenue		Annual Cost Recovery	
			2031	2050	2031	2050	2031	2050
Line 1: CMK loop	£227,752,000	£1,515,360	251,762	692,908	£503,525	£1,385,816	33%	91%
Line 2: Bletchley to CMK	£370,910,400	£1,894,200	357,549	384,018	£715,098	£768,035	38%	41%
Line 3: Caldecotte to CMK	£450,251,760	£1,894,200	705,350	1,117,468	£1,410,701	£2,234,936	74%	118%
Line 4: Woburn Sands to CMK	£475,908,720	£1,894,200	361,329	537,787	£722,657	£1,075,574	38%	57%
Line 5: Cranfield Uni to CMK	£578,768,960	£2,651,880	708,218	1,507,926	£1,416,437	£3,015,852	53%	114%
Line 6: East of M1 to CMK	£408,884,560	£1,894,200	612,517	1,222,836	£1,225,035	£2,445,671	65%	129%
Line 7: Northern MK Growth Area to CMK	£676,376,960	£3,030,720	721,851	2,388,997	£1,443,703	£4,777,994	48%	158%
Line 8: NW MK Growth Area and P&R to CMK	£601,730,080	£2,651,880	530,194	1,188,675	£1,060,389	£2,377,349	40%	90%
Line 9: Winslow to CMK	£682,233,440	£2,651,880	652,035	2,251,188	£1,304,069	£4,502,376	49%	170%
Line 10: SW MK Growth Area to CMK	£435,145,760	£2,273,040	555,721	1,875,936	£1,111,443	£3,751,871	49%	165%
Total	£4,450,878,320*	£22,351,560	5,456,528	13,167,738	£10,913,056	£26,335,476	49%	118%

*total takes into account shared sections of route

5.13 A line-by-line analysis of the performance of the proposed RT network is set out in Appendix A.

Illustrative 2050 service patterns

5.14 In order to address the overestimation of revenue in relation to cost for 2050 an exercise has been undertaken (for RTV) to match demand with capacity, while maintaining a maximum headway of nine minutes. This is summarised in Table 5-7 and highlights that once capacity is adjusted to reflect demand, revenue is likely to exceed costs by around 14%. It also highlights that demand is particularly high on lines with large numbers of new homes, including lines 7, 9 and 10, where the required headway is around 3.5 minutes. What this work also suggests is that in practice, if a tram network were provided, the addition cost of running a network with sufficient capacity to meet demand means it is highly unlikely to be viable.

Table 5-7: 2050 potential service pattern

Route	Operating cost	2050 headway	2050 demand	2050 capacity	2050 revenue	Cost recovery
Line 1: CMK loop	£1,155,000	6.0	692,908	708,120	£1,385,816	120%
Line 2: Bletchley to CMK	£1,155,000	9.0	384,018	708,120	£768,035	66%
Line 3: Caldecotte to CMK	£1,848,000	5.5	1,117,468	1,132,992	£2,234,936	121%
Line 4: Woburn Sands to CMK	£1,155,000	9.0	537,787	708,120	£1,075,574	93%
Line 5: Cranfield Uni to CMK	£2,541,000	6.0	1,507,926	1,557,864	£3,015,852	119%
Line 6: East of M1 to CMK	£2,079,000	5.0	1,222,836	1,274,616	£2,445,671	118%
Line 7: Northern MK Growth Area to CMK	£3,927,000	3.5	2,388,997	2,407,608	£4,777,994	122%
Line 8: NW MK Growth Area and P&R to CMK	£2,079,000	7.0	1,188,675	1,274,616	£2,377,349	114%
Line 9: Winslow to CMK	£3,927,000	4.0	2,251,188	2,407,608	£4,502,376	115%
Line 10: SW MK Growth Area to CMK	£3,234,000	3.5	1,875,936	1,982,736	£3,751,871	116%
Total	£23,100,000	-	13,167,738	14,162,400	£26,335,476	114%

5.15 Operating Lines 2 and 4 with a service pattern matched to demand would deliver a service with a 15-minute headway for Line 2 and a 12-minute headway for Line 4. This would not represent a 'turn up and go' service and therefore might depress demand for the services.

5.16 The figures set out in Table 5-5 and Table 5-6 are based on a line-by-line analysis and have not assumed any 'network effect'. This is the additional demand we believe will be generated when the whole network connects a larger number of destinations than is possible with single lines. For example, a high-level analysis of the potential additional demand that would be created by linking lines 2 and 6 together to form a cross-city route suggested a potential increase in trips of 48%. In practice the actual increase in demand across the network is likely to be lower than 48% because some of the longest trips possible on the RT network may take significantly longer than by car, particularly taking into account any 'interchange penalty' when changing between lines. The latter may be reduced by introducing cross-city routes and, where there is clear demand for longer trips, express services that have fewer intermediate stops. Any proposals for cross-city lines would need to be tested through development of a distribution model with appropriate generalised cost and deterrence factors.

Achievable journey times

5.17 As set out in Section 4, one of the key principles of the RT network is that it must be competitive, in terms of journey time, with the private car and provide reliable journeys. An analysis of journey time has been completed that compares the anticipated RT journey time with that by private car.

5.18 RT journey time has been calculated based on the assumed speed for each route type, a dwell time of 30 seconds at each stop and by adding half the headway in order to take account of wait times at the stops. For the private car journey time has been calculated making use of Google journey planner during the AM peak hour, incorporating a 14% growth in journey time to 2031 and a further 14% growth to 2050, on the assumption that journey will continue to increase as demand and therefore congestion grows.

5.19 Based on the proposed network, all lines with the exception of Line 8, provide journey times that are faster than the private car. A summary is provided in Table 5-8.

Table 5-8: Journey time comparison (2050) showing faster journeys (green), similar journey times highlighted (amber), slower journey times highlighted (red)

Route	RT journey time	Private Car journey time
Line 1: CMK loop	00:13:17	00:23:02
Line 2: Bletchley to CMK	00:17:12	00:17:55
Line 3: Caldecotte to CMK	00:19:00	00:25:36
Line 4: Woburn Sands to CMK	00:17:27	00:25:36
Line 5: Cranfield Uni to CMK	00:22:46	00:30:43
Line 6: East of M1 to CMK	00:18:29	00:23:02
Line 7: Northern MK Growth Area to CMK	00:27:22	00:38:24
Line 8: NW MK Growth Area and P&R to CMK	00:24:48	00:20:29
Line 9: Winslow to CMK	00:26:49	00:35:50
Line 10: SW MK Growth Area to CMK	00:19:41	00:20:29

5.20 The proposed network generally provides journey times that are quicker than the private car during typical AM peak congestion. Together with the high level of segregation proposed, and therefore the high degree of journey time reliability, it is reasonable to assume that the RT network will be a more attractive proposition than existing public transport services and attract people away from private car use for some trips.

5.21 A number of supporting measures will be required in order to ensure those lines that do not perform as well on journey time remain competitive with the private car, and are similarly appealing to car drivers. These are expected to include:

- A high quality ‘first/last mile’ transport network, particularly for those lines that depend more heavily on the existing urban area for demand where the opportunities to densify around the route are relatively limited in comparison to new development, such as Line 2.
- Traffic management measures within the city centre in relation to vehicle access, as well as parking management (quantity, location and price).
- Wider speed restrictions that reduce the general speed of traffic, improve safety and alter the noise levels associated with MK’s grid roads. This will improve the quality of the environment along the grid roads and reducing their severance effect, all of which is crucial to ensuring the RT stops are attractive to use.

5.22 Line 5 and Line 6 require dedicated infrastructure over the M1 in order to achieve the journey times set out above. For Line 5 it is proposed that this connection repurposes Broughton Grounds Lane but for Line 6 this will be a new connection. Both connections must be designed to ensure the RT routes are not impeded by other modes of travel.

5.23 Line 8 is around five minutes slower than the comparable private car journey time due to the high speeds possible along the A5 into the city centre by car. In order to provide competitive journey times, particularly for the P&R site, it would be necessary to consider ‘express services’ that might make use of the A5 at peak times. This may not be needed if other forms of travel demand management (such as parking restraint and pricing) are introduced in CMK and other key trip generators.

5.24 The major new communities proposed offer the opportunity to design the streets in such that gives significant priority to RT, walking and cycling but does not allow for local trips by car. This approach has been adopted successfully at a town scale in Europe, for example in Houten in the Netherlands and Freiburg in Germany. Such measures are critical here and will help to ensure that the RT network remains competitive with the private car, taking into account walk time to stops.

5.25 A detailed discussion of journey time by line is set out in Appendix A.

Indicative value for money

5.26 A high-level economic appraisal has been undertaken by ITP to provide some insight into the likely scale of costs and benefits over the lifetime of the project. The methodology applied to undertake this economic appraisal applied the latest DfT WebTAG guidance for determining the Value for Money of major transport schemes.

5.27 The first appraisal year is 2018, with opening of the first lines in 2025, full scheme benefits are realised in 2050 and the appraisal period runs until 2084. Three scenarios have been assessed to test the performance of the RT network under a range of potential future scenarios for both RTV and tram. The scenarios considered include:

1) MKC Mobility Strategy mode share scenario, based on the targets set out in Table 22 of the strategy and interpreted as:
   - 50% car driver
   - 4% car passenger
   - 20% RT
   - 24% active travel
   - 2% other
2) RT 'medium mode share' scenario, based on achieving 15% RT mode share with the full mode split as follows:
   - 55% car driver
   - 6% car passenger
   - 15% RT
   - 22% active travel
   - 2% other
3) RT costs 50% higher than forecast with MKC Mobility Strategy mode share.
   - Essentially a 'worst case' sensitivity test for higher costs and lower uptake than envisaged.

5.28 The marginal external benefits assessed as part of the appraisal include those achieved from a reduction in car trips (de-congestion, infrastructure, accidents, local air quality, noise and greenhouse gas emissions, balanced by the loss of indirect taxation). Pubilc health benefits have been calculated making use of the World Health Organisation's Health Economic Assessment Tool for walking and cycling and consider reduced deaths due to increased activity for walks to/from the RT stops, and along new walk/cycle infrastructure delivered as part of the RT network.

5.29 The costs are based on those identified in Table 5-5 and Table 5-6 with the addition of likely network infrastructure renewal costs over the lifetime of the project based on figures taken from the Luton to Dunstable Busway of £60,000 per km per year.

5.30 The marginal external benefits, health benefits, costs and resultant BCR for each scenario and for RTV and tram options is presented in Table 5-9.

Table 5-9: Economic appraisal BCR

Interventions	Scenario 1		Scenario 2		Scenario 3	
	RTV	Tram	RTV	Tram	RTV	Tram
Marginal External Benefits (cost benefits) (£m)	£3.4	£3.4	£2.7	£2.7	£3.4	£3.4
Health benefits (cost benefits) (£m)	£1.4	£1.4	£1.5	£1.5	£1.4	£1.4
Cost (including maintenance) (£m)	£1.1	£4.4	£1.1	£4.4	£1.6	£6.6
BCR	4.43	1.10	3.77	0.94	2.95	0.73

5.31 The DfT provides guidance on the value for money (VfM) of schemes based on the BCR that they achieve, as set out in Table 5-10.

Table 5-10: DfT VfM guidance[36]

VfM category	Implied by…
Very High	BCR greater than or equal to 4
High	BCR between 2 and 4
Medium	BCR between 1.5 and 2
Low	BCR between 1 and 1.5
Poor	BCR between 0 and 1
Very poor	BCR less than or equal to 0

[36] DfT Value for Money Framework: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/630704/value-for-money-framework.pdf

5.32 While it is important to stress the outline nature of the economic case developed by ITP as part of this early scoping work, and the need for detailed costings on a line-by-line basis, it is possible to suggest that:

- A tram option for the whole network returns BCRs between 0.73 to 1.10 depending on the scenario. This suggests a tram would represent 'poor' to 'low' value for money. However, it should be noted that in practice individual lines, where demand, and therefore the benefits, will be higher in comparison to cost would likely return a better BCR.
- A RTV option for the whole network returns BCRs between 2.95 and 4.43 depending on the scenario. This suggests RTV would represent 'high' to 'very high' value for money.
- The cost of a RTV network, at around £1bn, equates to a contribution of £10,000 per household if it assumed that there is a growth of 100,000 homes to 2050. It should be noted that experience suggests RT investment will result in higher values being generated Property values along tram routes in Manchester, Birmingham, Nottingham and Edinburgh have all seen increases above market level along new routes[37].

Mobility for all

5.33 As discussed in Section 2 levels of deprivation in Milton Keynes are increasing relative to the rest of the UK[38] and those 20% of people without access to cars do not benefit from the low-cost, rapid access to opportunities that driving offers. Accessibility analysis indicated that while all residential destinations within the borough are typically within a 20-minute journey of the city centre by car, only 23% of the population is within 20 minutes of the city centre by public transport (Table 2-4). This results in significant mobility inequalities in the city for those residents who do not own a car.

5.34 Accessibility mapping has been undertaken in order to determine the impact of the proposed RT network and the change in accessibility, particularly for the most deprived parts of the borough. The mapping shows the journey time by public transport from Milton Keynes central station to all points within the region. The existing situation is shown in Figure 5-2 and the future s4-1uation, with the full RT network is shown in Figure 5-3.

[37] House prices boosted after opening tram routes in five leading cities: https://www.lloydsbankinggroup.com/Media/Press-Releases/press-releases-2017/lloyds-bank/House_prices_boosted_after_opening_tram_routes/
[38] MK50 Futures Report, p16

Figure 5-2: Existing public transport journey time to Milton Keynes Central station

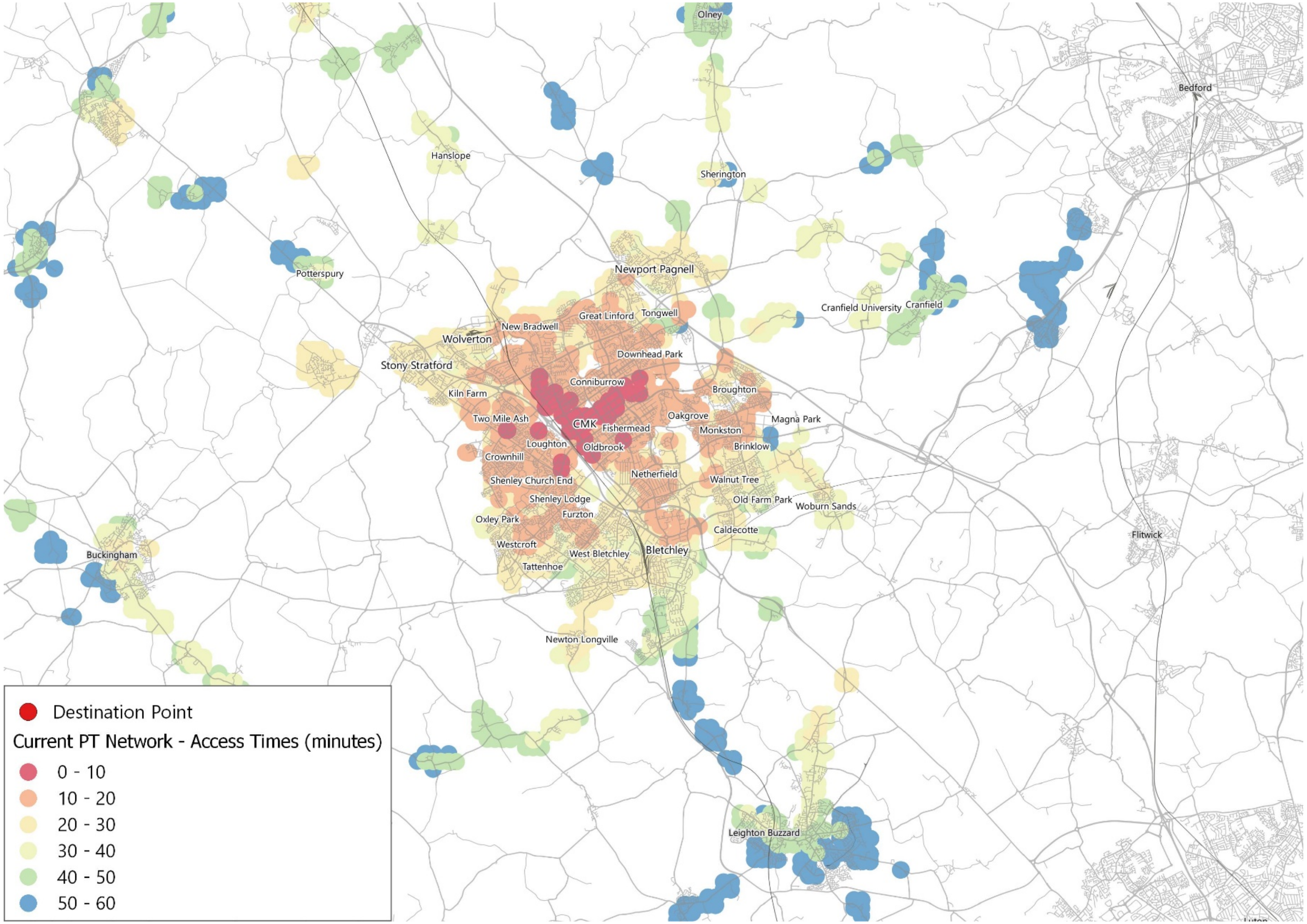
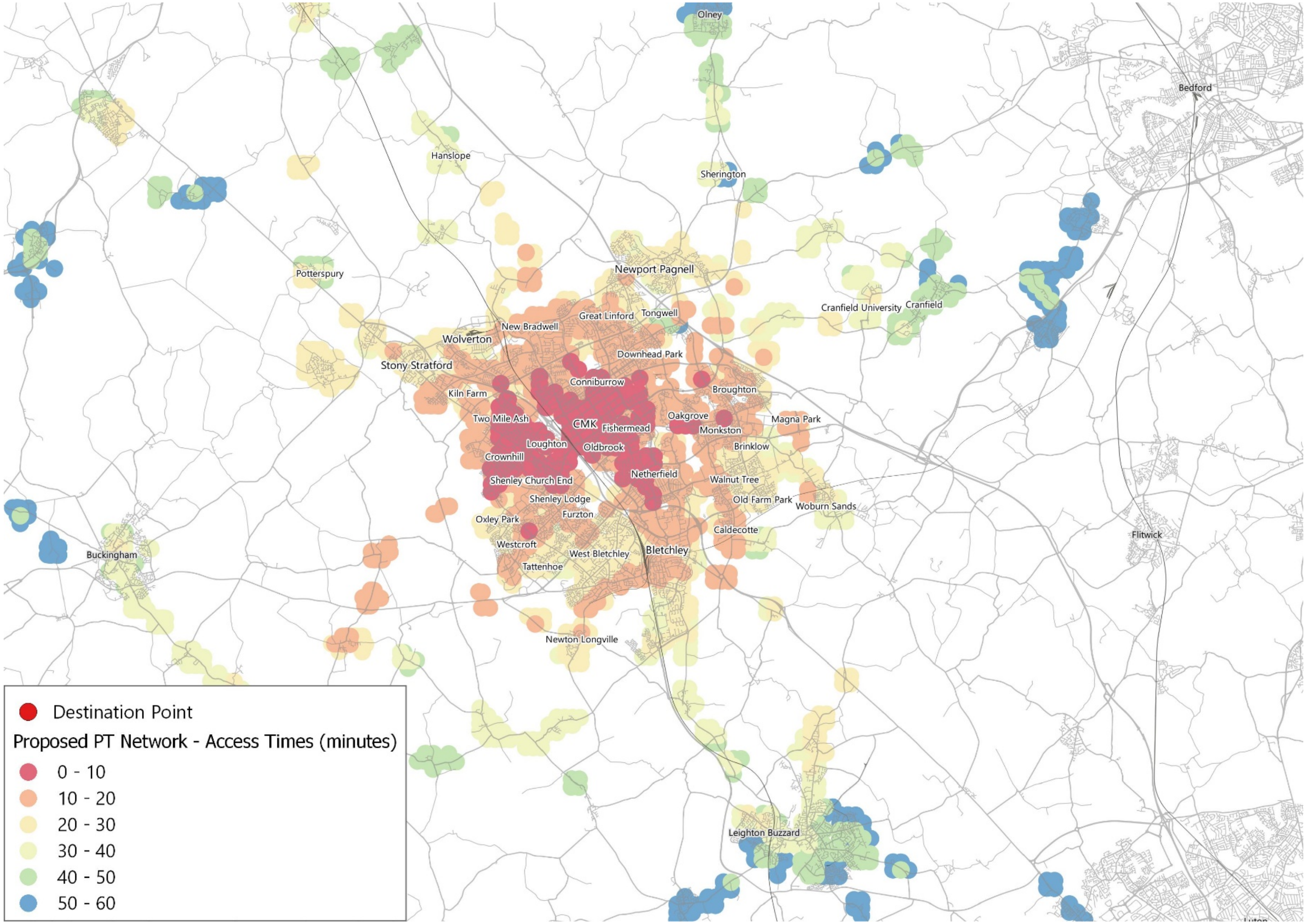


Figure 5-3: Public transport journey time with the RT network



5.35 The mapping indicates that the area of the city within a ten-minute journey time by public transport to the station increases with the introduction of the RT network, particularly to the south and west. As shown in Figure 2-4 the area with improved public transport accessibility correlates closely with the areas of greatest deprivation and lowest car ownership. In order to quantify this impact, an analysis has been undertaken of the change in public transport accessibility that the introduction of the RT network has for those people within the top 20% most deprived wards in the city.

5.36 As can be seen in Table 5-11 the proportion of the population within the most deprived wards within a 20 minute public transport journey time of central station increases from 24% currently to 39.5% following the introduction of the RT network (and increase in population from 10,503 to 16,959). This demonstrates that the RT network, and particularly the lines serving the most deprived wards, including lines 2, 3, 8, 9 and 10, will make a tangible contribution towards the MK Futures objective of delivering mobility for all within Milton Keynes.

Table 5-11: Proportion of population by journey time to city centre (20% most deprived wards), existing and with RT network

Journey time to centre (station)	Proportion of population (existing)	Proportion of population (with RT)	Change in population in each time band
0-10	0.2%	1.4%	624%
10-20	24.0%	39.5%	61%
20-30	54.7%	60.2%	-32%
30-40	66.6%	71.0%	-9%
40-50	83.2%	83.0%	-27%
50-60	100.0%	100.0%	1%

Opportunities from technology

5.37 As discussed in Section 4 there are likely to be significant technological changes taking place over the coming years and decades, many of which will have an implication on the operational characteristics and costs of RT. The most obvious of these is the adoption of autonomous technology into the public transport fleet.

5.38 The fixed nature of traditional public transport routes and therefore the high degree of predictability, particularly where significant segregation and priority is given, suggests that autonomous technology may be adopted first in public transport fleets. Indeed, in 2016 the Mercedes-Benz Future Bus operated autonomously along Europe's longest BRT route, between Schiphol Airport and Haarlem in Amsterdam, covering nearly 20km.

Figure 5-4: The 'Future Bus' operating autonomously over a 20km BRT route

5.39 Around 50-70% of the operating cost of running a bus relate to the driver[39]. If through autonomous operation this cost is substantially reduced, than the operating frequency of services can be dramatically increased without increasing significantly the operating cost. If, for example, costs are reduced by 50% then a headway of 4.5 minutes could be operated on all lines in 2031 without operating subsidy. By 2050 the headway could be reduced to two minutes on every line and break even. The ability to run the services at higher frequencies would improve the level of service to users, which would help to drive increased demand.

5.40 In practice the benefits of reduced operating costs could be utilised in different ways, for example focused on improving first/last mile options, extending the hours of operation of the service and improving the quality of vehicles and infrastructure. The options available would depend to a large extent on the operational arrangements in place and the ability of MKC to manage the network and services.

[39] TAS, Bus Industry Costs, Make Up and Trends: http://www.tas.uk.net/content/images/Session4-Costs-SteveWarburton.pdf

6. Phasing and delivery

Phasing

6.1 The viability of the proposed RT routes is driven by the new housing proposed as part of the growth study. As demonstrated in Table 5-5: Network Summary (RTV), a RTV network implemented with all routes would not be fully-viable in 2031, covering around 80% of its operating costs from revenue. Therefore, a phased approach is recommended that seeks to deliver RT in a way that responds to the demand arising from new development and that achieves wider benefits, particularly providing a network that delivers ‘mobility for all’.

Up to 2031

6.2 The following lines are proposed to be delivered in the first phase of implementation running to 2031:

- Line 1: CMK Loop
- Line 2: Bletchley to CMK
- Line 3: Caldecotte Growth Area and A5 P&R to CMK
- Line 4: Woburn Sands to CMK
- Line 6: East of M1 Growth Area and A509 P&R to CMK

6.3 These lines are focused on areas that will accelerate delivery of housing and employment land that is already allocated for development by 2031, and create scope to intercept CMK-bound trips through placement of Park & Ride sites on edge of the city’s urban area, as well as acting as catalysts for regeneration.

6.4 Taken together, and assuming limited competition for patronage in CMK for Line 1 (see discussion below), the annual cost recovery for operating costs for the lines by 2031 will be 81%, rising to 143% by 2050. In practice service frequency and stopping patterns are likely to be arranged in such a way to increase cost recovery in earlier stages (e.g. by reducing frequencies in off-peak periods) and to improve service levels in the longer-term (higher frequencies and longer operating hours) in order to cater for growing travel demand linked to growth. Even so, we assume that some form of subsidy may need to be made available in the early years of the network’s operation.

6.5 A detailed analysis of each line, including a more detailed description of trip generators by stop, is set out in Appendix A, while a summary is provided below.

Line 1: CMK Loop

6.6 Line 1 connects key destinations in CMK making use of Silbury Boulevard, Marlborough Gate, Avebury Boulevard and Elder Gate via Milton Keynes Central station. The line would operate two-way and would serve the existing commercial, residential and leisure uses in CMK as well as the significant Plan:MK allocated growth expected to 2031 and MKU.

6.7 Including Plan:MK allocations, along with the potential additional growth to 2050 identified in the growth study, the line has the potential to serve around 5,450 new homes by 2050, with significant new housing and employment floorspace delivered before 2031.

6.8 It is forecast that Line 1 would recover 54% of its costs through operating revenue by 2031. However, it should be noted that in order to ensure trips are not double counted, RT demand within CMK has been distributed across all ten lines serving the area with some sections of the CMK loop served by up to six lines. By 2031, when only five of the ten lines are implemented, the proportion of trips carried by Line 1 may therefore be slightly higher than indicated. It can also be assumed that the additional lines running by 2031 would have a more limited stopping pattern in CMK, ensuring faster journey times for users and allowing Line 1 to fulfil a more local role. Where there is little overlap between lines 85% of the operating costs of Line 1 are covered by 2031.

6.9 Line 1 will play an important role in demonstrating the principle of RT within Milton Keynes and will give the network a visible presence within the city that will help build awareness and drive demand.

Line 2: Bletchley to CMK

6.10 Line 2 connects Bletchley with CMK via the V7 corridor. The line has the potential to act as a catalyst for the potential regeneration of Bletchley town centre and station and, with the advent of East West Rail, will create a significant transport hub linking East-West Rail as well as the West Coast Mainline with the city. The line will serve the potential regeneration estates of Beanhill, Coffee Hall, Netherfield and Fishermead. These are currently some of the most deprived areas in Milton Keynes and the proposed line will improve access to the city for these areas. The line serves major existing trip generators such as Milton Keynes central, Stadium:MK, The Hub as well as additional demand from new housing and MKU within CMK. Importantly the route will also serve Milton Keynes hospital, which is an existing major trip generator that we anticipate will also need to grow as the city scales-up.

6.11 Including Plan:MK allocations, along with the potential additional growth to 2050 identified in the growth study, the line has the potential to serve around 1,575 new homes by 2050, with a significant number delivered before 2031.

6.12 It is forecast that Line 2 would recover 62% of its costs through operating revenue by 2031 and therefore would require some cross subsidisation from other routes across the network. However, the line has an important role to play in terms of the regeneration of Bletchley, which in itself is likely to generate significant additional demand that has not been taken into account. Furthermore, it will play an important role in acting as a catalyst for regeneration along the V7 corridor and in helping to address the mobility inequalities that exist in the area due to the high levels of deprivation and associated low levels of car ownership.

Line 3: Caldecotte Growth Area and A5 P&R to CMK

6.13 Line 3 connects the Plan:MK allocated sites around Caldecott and Eaton Leys with CMK. It will serve the Open University, which is a key employment location, as well as the hospital, a major and growing trip generator, and the V7 regeneration estates of Coffee Hall and Fishermead. The line is assumed to serve a new P&R at the A5 / A4146 of 520 spaces in 2031 and 750 spaces in 2050.

6.14 It is forecast that Line 3 would recover 122% of its costs through operating revenue by 2031. The line will have a significant role in facilitating the south eastern urban extension of Milton Keynes allocated in Plan:MK and, through the provision of a new park and ride on the A5, will free up parking and highway capacity within CMK for other uses.

Line 4: Woburn Sands to CMK

6.15 Line 4 connects the Plan:MK allocated South East Urban Extension ('SEMK') and growth around Wavendon and Magna Park. It also serves the potential growth area between Woburn Sands and J14 of the M1, as well as an improved Woburn Sands station on East-West Rail and the existing centres of Magna Park, Kingston and the regeneration estate of Fishermead. The line will serve around 7,000 new homes by 2050, around 5,000 are allocated within Plan:MK, as well as significant employment floorspace.

6.16 It is forecast that Line 4 would recover 63% of its costs through operating revenue by 2031 and therefore would require cross subsidisation from other routes on the network. However, the line has an important role to play in terms of the delivery of the south eastern urban extension and growth to the east of the city allocated in Plan:MK, and will also connect an enhanced station on East-West rail at or west of Woburn Sands, which will be an important interchange and mobility hub for the area.

Line 6: East of M1 Growth Area and A509 P&R to CMK

6.17 Line 6 serves the strategic housing and employment Plan:MK allocations to the east of the M1, along with significant growth areas to the east of Newport Pagnell and a new P&R on the A509. The line will serve around 10,200 new homes by 2050, around half of which are delivered by 2031 as part of the Eastern Urban Extension allocated in Plan:MK ('MK East'). An alternative routing via Dansteed Way and V8, rather than Childs Way, could be considered that would provide enhanced access to the network for estates along the route. However, this would add additional distance (and therefore journey time) and cost, as the route would not be sharing RT infrastructure with Line 5.

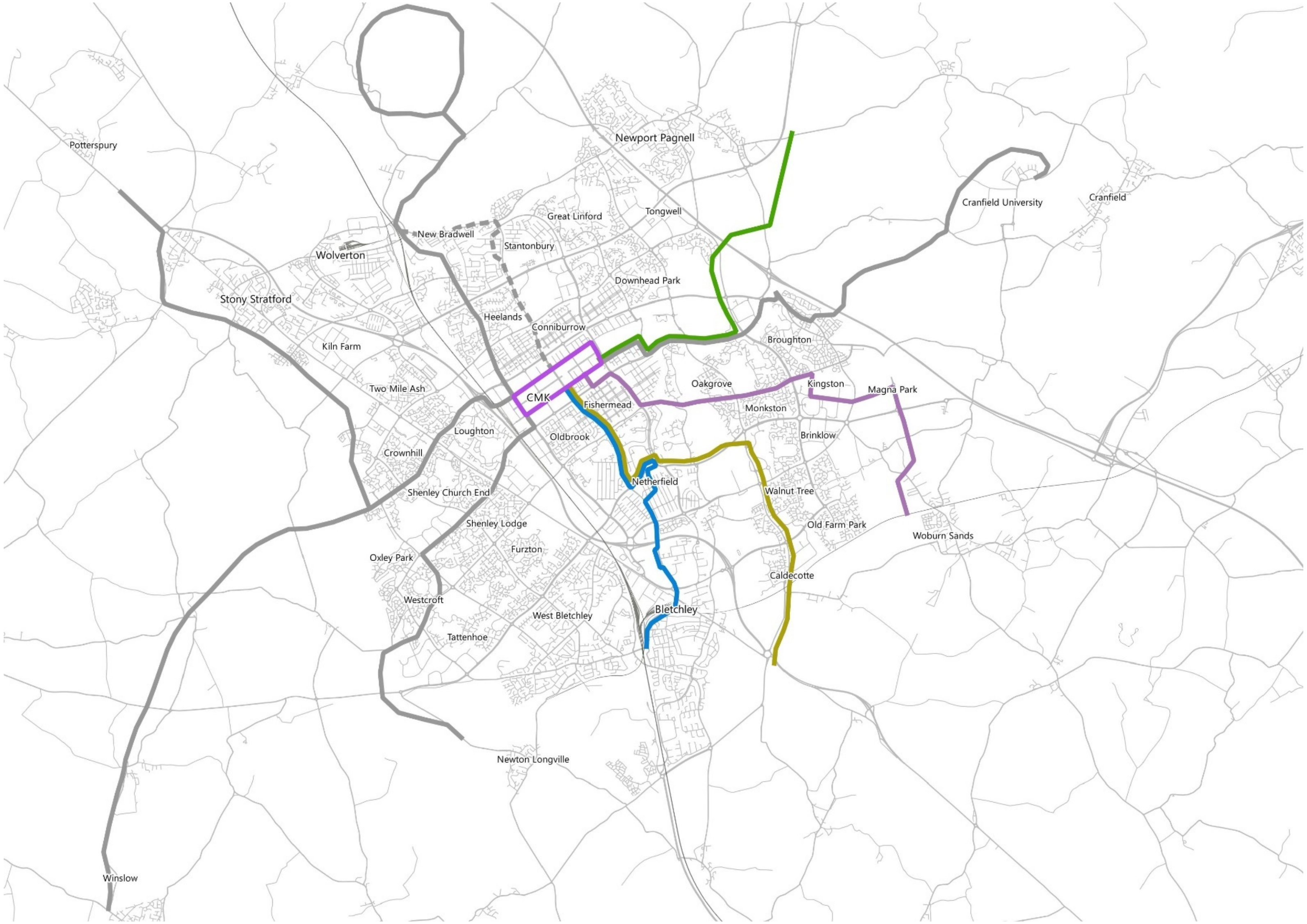
6.18 It is forecast that Line 6 would recover 106% of its costs through operating revenue by 2031. The line will have a significant role in unlocking development to the east of the city by 2031 and, through the provision of a new park and ride on the A509, will free up parking and highway capacity within CMK for other uses. The delivery of a new crossing over the M1 with dedicated running for RT will be essential to the implementation of this line.

Timeline for delivery

6.19 Clearly the exact phasing of delivery will depend on the location of development coming forward. Notwithstanding the above it is assumed that the first route delivered would be Line 1 by 2025, in order to establish the network within the city and to connect the areas of highest current demand, along with Line 3 and associated P&R. Line 2 would be phased in order to be a catalyst for regeneration along the route and would be delivered by 2031. Line 6 is likely to be delivered later in the period 2025-2031 due to the need to deliver a new M1 motorway crossing.

6.20 The 2031 network is shown in Figure 6-1.

Figure 6-1: RT network delivered by 2031



2031 to 2050

6.21 The remaining lines would be delivered between 2031 and 2050 and include:

- Line 5: Cranfield University to CMK
- Line 7: Northern MK Growth Area to CMK
- Line 8: NW MK Growth Area and A5 P&R to CMK
- Line 9: Winslow to CMK
- Line 10: SW MK Growth Area to CMK

6.22 These lines are focused on delivering the major TOD communities proposed as part of the growth study and are therefore are reliant on the demand from new development that will largely be delivered beyond 2031. A detailed analysis of each line is set out in Appendix A, while a summary is provided below.

Line 5: Cranfield University to CMK

6.23 Line 5 Serves Cranfield University, the potential growth area adjoining the university, Plan:MK allocations to the east of the M1 and the existing J14 P&R. The university is also anticipated to grow by around 70,000m^2 by 2050 and, along with the delivery by then of MKU, high quality connections between Cranfield and CMK will be crucial. The line will serve around 8,750 new homes by 2050, around 6,500 of which are in the new growth areas advocated as part of this growth study.

6.24 It is forecast that Line 5 would recover 187% of its costs through operating revenue by 2050 with a nine minute headway. However, as set out in Table 5-7 a service headway of five minutes will be required to meet demand, meaning the line would recover 119% of its costs.

Line 7: Northern MK Growth Area to CMK

6.25 Line 7 provides a loop that serves a strategic growth location to the north of the city. The alignment would be phased and would run initially along the V7 corridor taking in the regeneration estates of Bradville, Stantonbury, Conniburrow and Downs Barn. Once significant housing comes forward to the north the alignment would switch to the V6 corridor, serving Wolverton and potential regeneration around Bradville and Heelands, and allowing for quicker journey times to CMK. The line will serve around 20,400 new homes by 2050, the majority of which would be in the new TOD community north of Milton Keynes advocated as part of this growth study.

6.26 It is forecast that Line 7 would recover 259% of its costs through operating revenue by 2050 with a nine minute headway. However, as set out in Table 5-7, a service headway of 3.5 minutes will be required to meet demand, meaning the line would recover 122% of its costs.

Line 8: NW MK Growth Area and A5 P&R to CMK

6.27 Line 8 serves Plan:MK allocated growth around the Western Extension, as well a new growth area to the north of Old Stratford, a new A5 P&R and potential growth around Deanshanger. The alignment would not pass through Stony Stratford given the operational difficulties this would create in terms of providing priority and maintaining vehicle speed.

6.28 The P&R is assumed to deliver 600 spaces in 2050 and would tie in with any realignment of the A5 and new northern link road. In order to provide competitive journey times in comparison to the private car an 'express service' from the growth area and P&R along the A5 may be necessary during peak times. The line will serve around 8,000 new homes by 2050, around 5,000 of which would be in the new TOD communities advocated as part of this growth study.

6.29 It is forecast that Line 8 would recover 147% of its costs through operating revenue by 2050 with a nine-minute headway. However, as set out in Table 5-7, a service headway of eight minutes will be required to meet demand, meaning the line would recover 114% of its costs.

Line 9: Winslow to CMK

6.30 Should significant growth be allocated at Winslow (either Winslow itself and / or one or more new TOD communities between Winslow and Milton Keynes), then Line 9 could come into play serving this new growth outside the borough. Given the location of the communities within AVDC the delivery of the line would be entirely dependent on planning decisions by the District Council.

6.31 The line could also serve a new East-West rail station at Winslow and could connect to a new P&R on the A421(although this P&R hasn't been included in this assessment). The line could serve around 18,000 new homes by 2050, the majority of which would be in new growthy locations advocated as part of this growth study.

6.32 It is forecast that Line 9 would recover 278% of its costs through operating revenue by 2050 with a nine minute headway. However, as set out in Table 5-7, a service headway of four minutes will be required to meet demand, meaning the line would recover 115% of its costs.

Line 10: SW MK Growth Area to CMK

6.33 Line 10 serves Plan:MK allocated growth around Snelshall, new growth at SWMK (within AVDC), regeneration at West Croft, a potential A421 P&R as well as connecting major trip generators such as the Santander Head Office and Knowlhill. The line would serve around 16,600 new homes by 2050, around 13,000 of which would be in new growth locations advocated as part of this growth study.

6.34 It is forecast that Line 10 would recover 271% of its costs through operating revenue by 2050 with a nine minute headway. However, as set out in Table 5-7, a service headway of 3.5 minutes will be required to meet demand, meaning the line would recover 116% of its costs.

Timeline for delivery

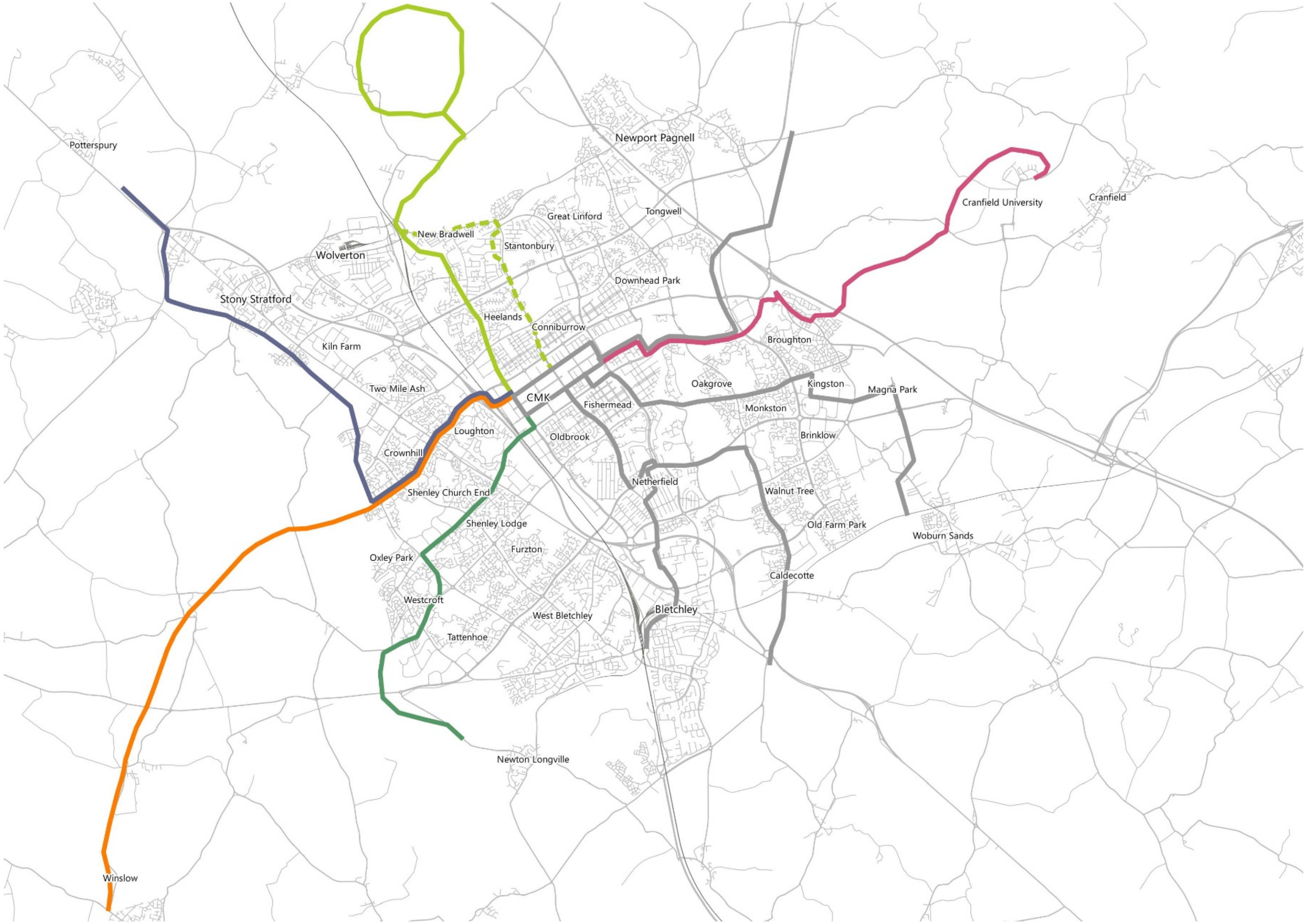
6.35 As for the earlier phase of delivery to 2031, the exact phasing of the lines will depend on the phasing of development coming forward. However, Line 5 (Cranfield University) is likely to come forward early as it will serve an expanding Cranfield University and new communities within the borough of Milton Keynes, as well as potentially serving Plan:MK allocated land and making use of Fen Street that has passive provision for rapid transit. Line 10 (SW MK Growth Area) is likely to come forward early as it could connect to a new P&R, as well as significant Plan:MK allocated land within the borough of Milton Keynes, intensification at Westcroft District Centre and the burgeoning employment centres at Shenley Wood and Knowlhill. However, growth to the south west of Milton Keynes sits within AVDC and this represents a significant component of demand for the line.

6.36 Line 7 (Northern MK Growth Area) is dependent on the delivery of new housing, this land is all within the borough of Milton Keynes and is likely to be a medium-term prospect given the scale of growth proposed.

6.37 Line 8 (NW MK Growth Area and P&R) is dependent on a new P&R, which in turn is dependent on a realignment of the A5 and on securing a high-quality route through the Plan:MK Western Extension. Line 9 (Winslow) is entirely dependent on the delivery of significant growth within AVDC at Winslow or between Winslow and Milton Keynes. Both Line 8 and 9 are likely to delivered toward the end of the growth study period.

6.38 The lines to be delivered between 2031 and 2050 are shown in Figure 6-2.

Figure 6-2: RT network to be delivered between 2031 and 2050



Operational considerations for creating an RT network

6.39 There are a number of high-level operational considerations for the detailed design of any RT:MK network. They relate to controlling access to the RT network and the powers that might be taken on to manage it.

6.40 The proposed RT network will provide a high quality, direct, reliable and comprehensive series of routes that will be attractive to use by a range of operators. Therefore, access to the RT network will need to be managed in order to ensure that RT vehicles are given priority. This will involve controlling access and might require adopting powers set out in existing legislation, for example entering into Enhanced Partnerships with operators as set out in the Bus Services Act 2017. This would allow MKC to agree a range of quality related factors including:

- the quality of vehicles (eg wifi, charging points)
- environmental standards of vehicles
- service frequency and hours of operation
- smart cards and contactless payment
- multi operator tickets
- common ticket rules and fare zones

6.41 If operators did not meet the agreed standards, then they would not be permitted to use the RT infrastructure.

6.42 If a Development Corporation were created, the opportunity might become available to consider routes to additional powers, for example the creation of a Combined Authority or Integrated Transport Authority (ITA) that could seek franchising powers for the RT network. Franchising would allow the local authority to stipulate in more detail the operating pattern of services and to ensure that the desired levels of service are achieved in a way that is efficient and delivers high quality to service users. The market would still be able to spot and fill any gaps in the network as long as they do not undermine the core franchised services.

6.43 As discussed throughout this report, a coherent 'first/last mile' network of services is essential in order to deliver a coherent and attractive service to users, particularly in the lower density areas of the existing city. MaaS will be a key component in ensuring a seamless journey across the network taking in all modes. However, there is a danger that if left entirely unregulated the delivery of MaaS, particularly once CAVs become a larger part of the transport mix, could undermine RT and result in significantly increased congestion while perpetuating the existing mobility inequalities. This is because if there is no incentive to only use 'first/last mile' CAV options as a means of accessing the RT network then such options will compete with RT, reducing demand and increasing congestion as total vehicle miles travelled increase (see Figure 3-2). It is also likely that in this scenario the most deprived in society will be least able to afford access to CAVs and therefore will be disadvantaged.

6.44 As CAVs develop the tools to manage their access to the highway network, charging, taxation and liability, will all need to be developed at a national level. However, Milton Keynes is likely to remain at the cutting edge of innovation in this regard and MKC should make best use of its position to bring about positive outcomes as the technology develops. At a more local level MKC can ensure that its policies and actions create a mix of incentives that ensures RT has the right conditions to flourish. These are considered in more detail below.

Other measures required to support RT

6.45 As well as delivering the core RT network described above, a wide range of additional measures will need to be implemented if the network is to be successfully established and operate effectively over time.

City wide parking strategy, including P&R

6.46 Milton Keynes currently has substantially higher levels of parking provided per job, offered at a significantly lower price than in towns and cities of a similar scale. This means that parking is often cheaper than using the bus and is generally available close to workplaces – meaning public transport cannot compete on cost or convenience.

6.47 Policies to reduce the relative levels of parking per job significantly over the timeframe of this study should form an integral part of the wider mobility for all strategy, and ideally absolute levels of parking should also decline. This should happen in tandem with the development of a P&R strategy, that places such facilities at key gateways into the city that are connected to the RT network. Such a strategy would allow longer-distance commuters and visitors to be able to travel by car to the edge of town, and then interchange for a quick and convenient transfer into MK.

6.48 With reduced levels of parking, particularly within CMK, the opportunities to re-purpose land for other uses and improved public realm are substantial. This will have the associated benefit of increasing activity and vitality within the city, helping to make it a more attractive place to work and visit, as well as driving demand for RT.

City centre access control and pricing

6.49 Allied to the above, charging car users more directly for the use of parking and access to the highway network could prove to be useful tools for managing travel demand, reducing emissions linked to transport, and raising revenues that can be spent on improving sustainable travel options.

6.50 Many cities in the UK are currently exploring the possibility of implementing Workplace Parking Levy (implemented in Nottingham) and Clean Air/Low Emission Zones as mechanisms for doing just this. Central Government is also understood to be starting to consider alternative methods of taxation for private car travel, as receipts from emissions-linked Vehicle Tax are projected to decline with uptake in electric vehicles.

6.51 In Nottingham charging started as part of a WPL in 2012. The funds raised, and the reliable source of income into the future, has been used to lever in funding for major transport infrastructure, including a £570m extension of the tram network and a £60m redevelopment of the city's railway station. While the makeup of workplace parking stock and ownership in MK may not make WPL relevant here, the mechanisms for using pricing to manage demand and restricting supply so that the land can be put to more productive uses are both valid and tried and tested across the UK and Europe.

Safeguarding of RT routes

6.52 With significant numbers of sites allocated in Plan:MK and substantial new sites likely to come forward to 2050, it is imperative that the RT route network is safeguarded in new development. As well as safeguarding land within new development sites, any development that prejudices the delivery of the RT network along the existing grid roads corridors should also be strongly resisted. In order to secure this, the preferred RT route network should be adopted by MKC, along with policy resisting development that prejudices the delivery of the network or undermines the priority measures to be given to RT on the network. We expect this will require a policy to be adopted as part of a future Local Plan review.

Reducing car parking levels and vehicle access in new developments

6.53 The provision of car parking, both at the origin and destination end of trips, has a significant influence on mode choice, along with accessibility to public transport[40]. Therefore, where development is located within the catchment of the RT network,

[40] See discussion in 'Delivering High Quality Places' in Section 3

policy supporting a decrease in parking levels below those traditionally applied within Milton Keynes will be necessary.

6.54 As well as managing car parking levels, private vehicle access should also be carefully managed. Within new developments this means designing the street network so that RT, walking and cycling is given direct access, while trips by private car are significantly less direct. This has been implemented successfully in exemplars of sustainable urban development such as Houten, in the Netherlands, and Freiburg in Germany. This approach ensures shorter trips are always more convenient by sustainable modes, which reduces the volume of car traffic within developments and improves the quality of the urban environment, encouraging more activity and contributing to a greater sense of community. A series of growth typologies have been developed (see Chapter 7 of DLA's Strategic Growth Study) that include Completing the Grid, Rail-Based Transit Growth, New TOD Communities and Intensification and Regeneration. While all typologies will be underpinned by RT, the approach to key factors such as density and street layout will vary for each. Therefore, the application of the principles outlined above will also vary and will need to reflect the specific context and form of development proposed.

6.55 Away from residential areas, reducing vehicle access means that more space can be provided for active uses in a way that encourages greater use of the public realm. This might include targeted pedestrianisation, as well as wider application of the filtered permeability approach discussed in Section 2 in order to encourage greater uptake of walking and cycling. In all cases restrictions for private vehicles should not apply to RT to ensure that significant journey time benefits can be achieved.

Enhanced walking and cycling network

6.56 As described in Section 3, a key outcome of the RT network must be to enhance direct cycle connections across the city and the city centre, in line with the recommendations set out in the National Infrastructure Commission report "Running out of Road"[41], and taking advantage of the ability to provide cycle routes adjacent to the RT lines, as has been delivered in Cambridge. By creating a more coherent cycle network that complements and addresses the deficiencies of the Redway network, delivery of RT can also drive-up widespread uptake of cycling for everyday trips.

6.57 The quality of the environment at RT stops and along routes within the development sites must be of the highest quality in order to encourage walking and to reduce

[41] Andrew Gilligan, 2018: Running out of road: Investing in cycling in Cambridge, Milton Keynes and Oxford

severance within and across the grid roads and squares. The land required to achieve these objectives should be designed-in and safeguarded in the same as for the core RT routes.

Delivering Transit Oriented Development

6.58 Development densities will respond to the growth typology proposed, as set out in the Strategic Growth Study report prepared by DLA. The highest densities will be found within the New TOD Communities typology and where multiple lines meet or there are interchanges with rail stations, such as within the Rail-Based Transit Growth typology. In all growth typologies development should be delivered at higher densities in and around RT nodes. Higher density is essential to ensuring the RT routes have the catchment necessary to deliver viable levels of demand. The financial and operational analysis underpinning the proposed RT network has assumed that 85% of all new growth proposed on a RT line is within the walking catchment of services. It is very likely that if low density development with high levels of car parking is provided the RT network will not be sustainable. It is recognised that in some locations higher levels of car parking may be appropriate, for example at the edges of growth locations furthest from RT.

6.59 The presence of RT will also encourage higher density development within a convenient walk (~600m) of stops on grid roads. This should be facilitated through policy and development briefs as it will not only drive demand for RT but can also be used to better connect the existing urban areas to the RT network. This is important in terms of spreading the benefits of RT to existing communities and delivering ‘mobility for all’.

6.60 The objectives of TOD and development around RT nodes on grid roads should be incorporated into policy, as discussed for safeguarding above.

Prioritising RT infrastructure

6.61 A crucial element of delivering the level of priority for RT described above will be ensuring the timely delivery of infrastructure, particularly in relation to connections over the M1. More generally the delivery of highway infrastructure should not preclude the delivery of RT alignments within the grid roads and at junctions, for example to allow for ‘hamburger’ style junctions. Crucially, infrastructure decisions should not ‘lock in’ car dependent lifestyles through providing substantial highway capacity at the expense of alternative modes.

6.62 Although there will be the need to deliver some essential increases to highway capacity at key points on the network, for example to address existing capacity issues around the M1, this should be designed in such a way as to ensure it does not induce additional demand or prejudice the delivery of RT. Planning for the highway network should take into account the RT network and the modal shift it will generate and should only accommodate residual highway demand.

6.63 The raising of development related funding through CIL, S106 or any future tariff mechanisms should be focused primarily on delivery of the RT network and essential capacity interventions on the highway.

Multimodal integration

6.64 A fully-functioning RT network is about more than high quality vehicles running in their own space. As illustrated by Figure 4-4, the implementation of integrated fares and payment systems across multiple mobility service operators – all aggregated via multiple digital channels so that people can plan journeys quickly and easily – is a core component of mass rapid transit. The example of London – where Oyster, TfL and open-data powered journey planners, and integrated information (if not payment) for Car Clubs, cycle hire and Uber has been achieved – is what we advocate MKC should be striving for in its efforts to deliver a RT network as part of the windfall associated with planned, long-term spatial growth. At a closer scale to where MK aims to be in 2050, Nottingham has achieved most of these components, but with a fraction of the budget available in London and largely in partnership with local public transport operators (rather than through the use of franchising powers).

Funding opportunities

6.65 A range of funding sources will be required to deliver the RT network and these will need to be developed in more detail as part of the growth strategy and mobility strategy. The most likely sources of funding include:

- **Central Government investment** – this study has highlighted the potential for RT to be delivered as both a means to, and an end of, accelerating the delivery of higher numbers of homes and new jobs over a 30-year period. Up-front investment in infrastructure would ideally be part/fully funded by central government in recognition of the key role MKC would be playing in committing to accommodating a significant number of new homes and workplaces in the local area. Any form of Growth Deal for RT infrastructure would likely need to be accompanied by similar investment in education, healthcare, leisure and community facilities.

- **CIL, S106, MK development tariff** – with around 100,000 homes being constructed to 2050, a substantial source of revenue will be via development-related payments. Experience suggests RT investment will result in higher values being generated, for example a 10% increase (above market) in property values was realised close to stops along the NET Line 1 corridor in Nottingham. Development-related payments could be linked to the delivery of homes in allocated growth sites and serve as a mechanism for supporting RT services until sufficient numbers of homes have been completed in order for high-frequency service schedules to be maintained on a commercial basis. Adopting a tariff-based approach would likely provide MKC with greatest flexibility in respect of claiming contributions from across all locations and using them to invest in other parts of the RT network (delivering city-wide benefits). In recognition of the urgent national need to accelerate housing delivery, and the critical reliance of RT service viability on the delivery of new homes in some locations, MCK could consider offering a discounted tariff to landowners and developers that prioritise early delivery and accept development frameworks that support patterns of mixed, higher density, low-car land uses close to RT stops and mobility hubs.
- **Development Corporation**, if created in MK, a Development Corporation may present wider opportunities to fund RT infrastructure. These are likely to include borrowing against planned development receipts, capturing land value uplift – particularly from MKC-owned land - and future service charges aimed at maintaining the RT network over the long-term.
- **Demand management measures** – As demonstrated in city's like Nottingham, prudential borrowing can be raised against future revenue from schemes such as a Workplace Parking Levy (WPL), road user/clean air zone charging, future fare box revenue and car parking revenues. Although potentially unpopular with the local business community, such interventions are typically effective at both reducing demand for car-based travel into city centres, as well as generating higher levels of revenue income (critical, and often lacking in the public sector) that can be ring-fenced for transport network investment and support.
- **Private sector partnerships** – There may be some willingness from bus operators and/or other mobility service providers to cross-subsidise the up-front cost of a dedicated RT network, or to cover the cost of its maintenance over time through access charges. Co-investment in RT network proposals now could help to safeguard the future of these businesses (in the face of competition from small-

vehicle mobility services that are less efficient, in roadspace and air quality terms, for high frequency, high volume trips) and involve local public transport operators in the process of establishing a set of transit communities that would represent a sound future market for the form of mobility they offer.

6.66 As well as the potential funding sources set out above, developers may also deliver sections of the RT network external to their sites in lieu, in full or part, of financial contributions related to the delivery of physical infrastructure. This could be secured by way of S278 agreement.

7. Conclusions and next steps

Conclusions

7.1 This study has considered the existing transport context within Milton Keyes and the negative implications for public health, the environment and equality that the overly car dependent transport system results in. The aspiration for significant growth of the city to 500,000 by 2050 will substantially increase travel demand and a 'more of the same' approach will not allow 'good growth' to be achieved, as it will result in unacceptable levels of congestion and growing mobility inequality.

7.2 A series of future mobility scenarios have been considered and it is concluded that while technology, such as CAVs, will have a crucial role to play in the future of mobility in Milton Keynes, a high capacity RT network will be required to meet the levels of demand forecast while delivering 'good growth'.

7.3 The proposed RT network has been developed alongside the growth study work undertaken by DLA to ensure there is a symbiotic relationship between growth and RT such that the location and form of development is conducive to RT, drives demand and brings benefits to the existing city. The network has also been designed so that it can act as a catalyst for regeneration and, through widening access to existing and new opportunities within the city, will help deliver on the ambition of 'mobility for all'.

7.4 The study assessed both RTV and tram mode options for RT and concludes that RTV options are most likely to deliver high value for money and limit risk for investors. A tram option is unlikely to be viable in terms of the scale of demand over the whole network, although individual lines may become viable with tram towards 2050 (and could be upgraded at a later date, if so desired). However, the study has noted that many of the perceived benefits of tram can already be secured through a RTV approach, and developments in technology, particularly in relation to guidance systems, autonomy and electric propulsion, appear set to further close the gap.

7.5 The study has concluded that a RTV RT network is viable based on the likely additional demand generated by a near doubling of the city to 2050. However, this is dependent on development being delivered in a form that is conducive to RT, with a wide range of supporting measurers also needing to be implemented that require a significant and multi-agency policy shift in MK. This emphasises that RT is a 'prize' that can only be secured through planned growth of the city, and provided that it is not considered in isolation but as a central part of urban planning for the future. It also underlines the need for cross-party political support, as part of a shared long-term vision for how

MK's growth (much of which is expected to happen anyway, but in a less-strategic way) will be directed and accommodated.

7.6 Potential phasing options for the network have been set out that respond to the likely phasing of development, potential regeneration sites within MK, and the delivery of major infrastructure as part of the Cambridge – Milton Keynes – Oxford Corridor. A network proposal for five initial routes (including a loop around Central Milton Keynes) up to 2031 has been established, along with a timeline for delivery of the full network of five cross-city lines (ten individual routes) up to 2050.

7.7 With traffic congestion already beginning to be experienced at peak times on the highway network, and strategic transport modelling indicating this will get significantly worse over the coming years, it is clear that decisions need to be taken now if Milton Keynes' is to set itself on a new path towards 'smart, shared, sustainable mobility' that delivers RT at its core.

Next Steps

7.8 The contents of this report, and the wider growth study being prepared by DLA, should be considered in detail by the key Local Authorities. The conclusions can feed into wider corporate thinking, including development of imminent rounds of local planning and transport policies. In particular policy changes might focus on the elements set out in Section 6 related to parking strategy, city centre access and parking levels, residential parking levels, safeguarding of RT routes (on the highway and within development sites), support of TOD, cycle parking and cycle and walking priority infrastructure and measures.

7.9 Further development work is required to determine the detail of the RT network proposals set out in this report. Such work would build on the high-level appraisal undertaken as part of this study and should ideally focus on developing the preferred network and initial route options so that a first phase can be developed in detail, costed and appraised for DfT/MHCLG consideration through a Strategic Outline Business Case.

7.10 Such work would be consistent with the Growth Deal activities that are being undertaken in other locations in England, with potential for dedicated Housing Infrastructure Fund (HIF) and other bids to follow from this work in order to secure the funding needed to prime and deliver the first RT routes and complementary interventions (such as integrated fares, real time information, interchange facilities, Traffic Control System upgrades).