MILESTONE INFRASTRUCTURE

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University Access Study

Package Assessment Report

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Document Control

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1. Introduction

1.1 Background

1.1.1 The purpose of the University Access Study is to identify transport improvements that can address existing and future issues of congestion and severance associated with accessing the Embankment Area, and the east of Peterborough City Centre.

1.1.2 The University Access Study focuses on the transport network which provides access to the Embankment Area, including Junction 5 of the A1139 Frank Perkins Parkway and the surrounding highway network including Bishop's Road, Vineyard Road and Boongate. It also considers the southern part of Fengate including the Boongate / Fengate Junction which also connects the Embankment Area to Fengate.

1.1.3 The routes included within the study area all connect the City Centre with the A1139 Frank Perkins Parkway via Junction 5. The routes are sensitive to local traffic conditions, and if one route is experiencing high levels of congestion and delay, vehicles will use the alternative route to Junction 5.

1.1.4 Figure 1.1 shows a plan of the study area.

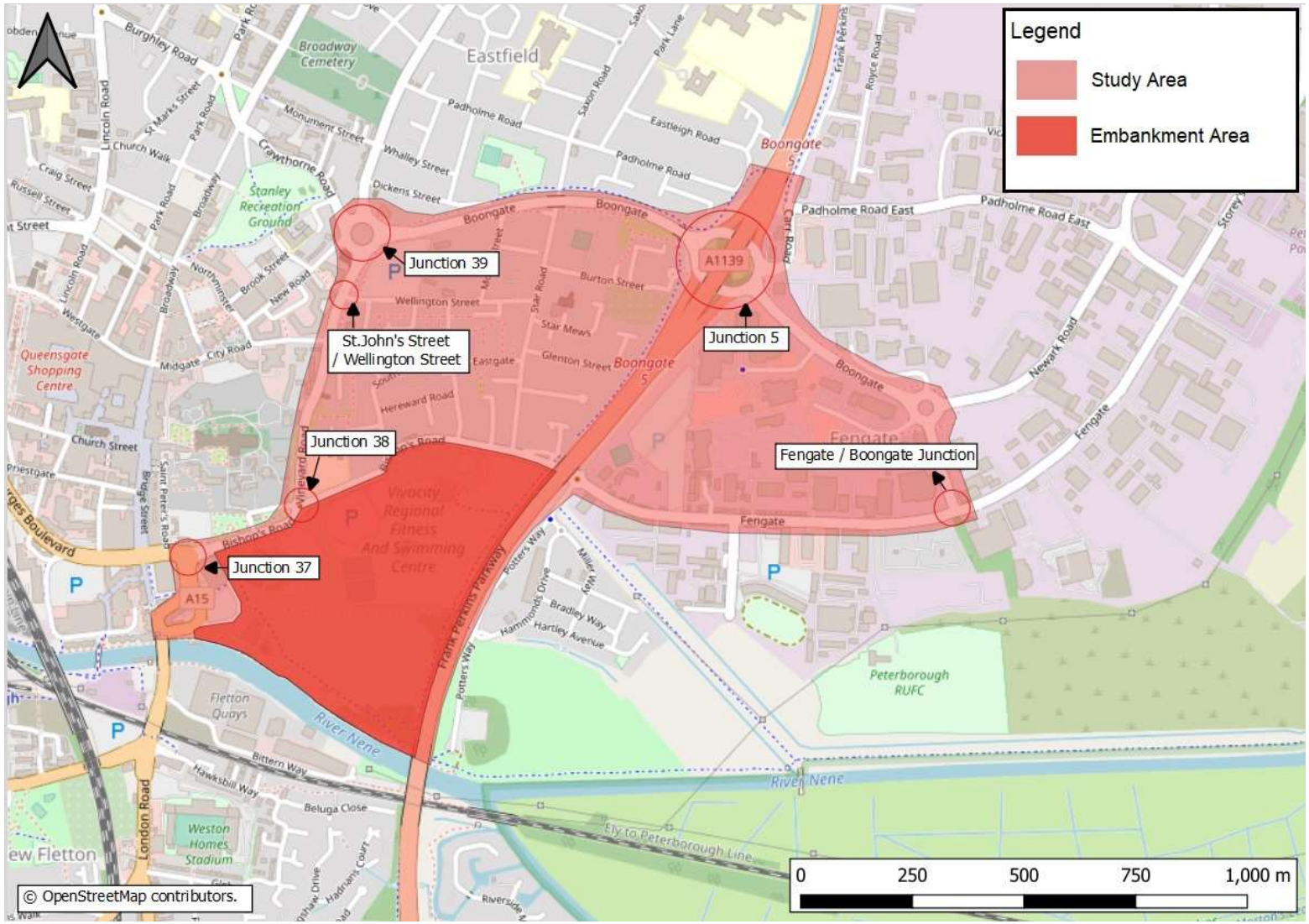

Figure 1.1: University Access Study Area

1.1.5 The City Centre is entering a new and exciting phase in its development, a phase that will deliver significant levels of growth, and the Embankment Area is identified as an opportunity area by Peterborough City Council, and includes proposals for a new University of Peterborough (referred to as ARU Peterborough from hereon), as well as supporting infrastructure such as the Fletton Quays Footbridge, a new pedestrian and cycle bridge connecting Fletton Quays to the Embankment Area.

1.1.6 Evidence of existing and future conditions at key junctions within the study area have demonstrated congestion and delay during the peak hours, and these are forecast to get worse with the proposed growth if no improvements are made.

1.1.7 The scheme has a number of primary and secondary objectives. The primary objectives are:

- Tackle congestion and reduce delay: Tackle congestion at key pinch points across the study area and reduce delay on routes to the Embankment Area
- Support Peterborough's Growth Agenda and facilitate the development of the Embankment Area including ARU Peterborough: Ensure the planned University development and other growth aspirations at the site can be accommodated within the highway network.

1.1.8 The secondary objectives include:

- Positively impact traffic conditions on the wider network: Positively impact the performance of local routes impacted by the traffic and congestion in and around the study area
- Improve Road Safety: Reduce personal injury accidents and improve personal security amongst all travellers
- Limit impact on the local environment and enhance biodiversity: Mitigate any adverse impact of a scheme and enhance biodiversity net gain within the study area.

1.2 Wider Context

1.2.1 There are a number of external influences which have an impact on this project, and the identification of a preferred option. These are discussed in turn below.

ARU Peterborough

1.2.2 ARU Peterborough will deliver an independent, campus-based university of 8,000 students and 1,250 staff located at the heart of the city by 2035. The new University will be fast-growing from 2022 to 2028 (with phased infrastructure)1:

- Phase 1: a first university building in Peterborough City Centre from September 2022 with capacity for around 4,000 students
- Phase 2: R&D, innovation, and incubator expansion. This will centre on Advanced Manufacturing and Materials Research for educational research and development.
- Phase 3: growth from 2025 up to around 6,500 students on roll by 2030. It comprises two further teaching focussed buildings, opening in 2025 and 2028, with an associated student union building and infrastructure works to open in 2025.

1.2.3 Phase 1 of the university received planning permission in November 2020 and will be built upon the existing Wirrina car park. A ground-breaking ceremony was held on the 8th of December 2020, with Phase 1 of ARU Peterborough is expected to open in September 2022. The Phase 2 Planning Application received permission in June 2021, and the Phase 3 application is expected in Autumn 2021. Development of the highway schemes is needed to provide the highway capacity for growth, which is already underway, within this area of the City Centre.

1 https://cambridgeshirepeterborough-ca.gov.uk/assets/Growth-Funds/2020.09.22-CSR-University-for-Peterborough-phase-3-final.pdf

Embankment Regeneration

1.2.4 The Embankment Area is predominantly open space facilitating social, recreational, leisure and cultural uses, but is supported by the inclusion of the Key Theatre, the Grade II listed Lido Outdoor Swimming Pool and the Regional Fitness and Swimming Centre as well as the Peterborough Athletics Track. In addition, there are several large surface car parks along Bishop's Road. However, the space is currently significantly underutilised, hence the need for regeneration.

1.2.5 An Embankment Masterplan is being prepared by Peterborough City Council and is expected to be completed by May 2022. This masterplan will inform the redevelopment that will take place on the Embankment as well as address the need for walking and cycling connection into and out of the site as well as within the site itself. This will include an improved frontage on the River Nene making it an attractive place for residents, worker, visitors to spend time.

1.2.6 Peterborough United Football Club have also expressed an interest in relocating the Peterborough United Football Stadium to the Embankment from their current location on London Road.

City Centre Transport Vision

1.2.7 To complement the City Centre development aspirations, a City Centre Transport Vision was prepared to guide future planning policy and provide an ambitious vision that can provide consistency to future development and growth within the City Centre. The vision embraces emerging technologies and a shift in travel behaviour. This includes the delivery of multi-functional transport hubs on the periphery of the city centre, providing the vast majority of City Centre car parking (private and public), and transition points for goods and deliveries destined for the City Centre.

1.3 Strategic Outline Business Case

1.3.1 The University Access Study Strategic Outline Business Case (SOBC) was submitted in December 2020 and made a strong strategic and economic case for improvements in the University Access study area.

1.3.2 Two packages of schemes were identified to add capacity to the highway network and address the existing problems of peak hour congestion and delay at key junctions within the study area. Additionally, they will help facilitate development at the Embankment Area and across the wider City Centre area by reducing severance.

1.3.3 The key difference between the two packages of schemes is that Package 1 provides a new northbound off-slip (Junction 4a) between A1139 Frank Perkins Parkway and Bishops Road. Package 2 includes the dualling of Boongate between Junction 5 (A1139 Frank Perkins Parkway / Boongate) and Junction 39 (Crawthorne Road / Eastfield Road / Boongate / St John's Street / New Road)

1.3.4 Package 1 included the following improvements in the SOBC:

- New northbound off-slip linking the A1139 Frank Perkins Parkway with Bishop's Road (Junction 4a)
- Junction 38 – 40m flare extension on Bishop's Road East
- Junction 5 – signalisation of the A1139 Frank Perkins Parkway southbound off-slip
- Boongate / Fengate Junction – 40m flare extension on Fengate West and creation of a dedicated right turn lane on Fengate East
- St John's Street / Wellington Street – creation of a roundabout.

1.3.5 Figure 1.2 shows a plan of the proposed improvements which form Package 1.

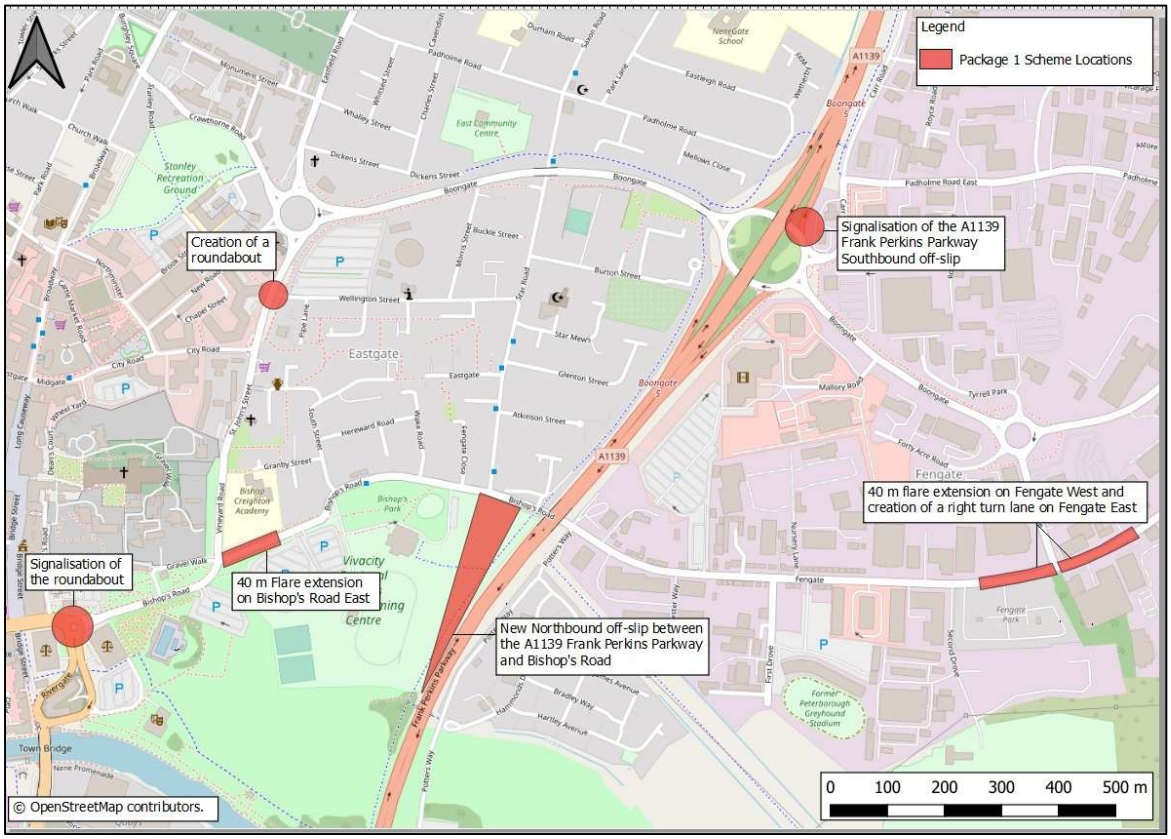

Figure 1.2: Package 1 Improvements

1.3.6 Package 2 contained the following improvements in the SOBC:

- Boongate West – dualling between Junction 5 and Junction 39
- Junction 5 – signalisation of A1139 Frank Perkins Parkway northbound and southbound off-slips, extension of the northbound off-slip left turn flare by approximately 20m, and provision of a left dedicated lane from the A1139 Frank Perkins Parkway northbound off-slip to Boongate West
- Junction 38 – 40m flare extension to Bishop's Road East
- Boongate / Fengate Junction – 40m flare extension on Fengate West and creation of a dedicated right turn lane on Fengate East
- St John's Street / Wellington Street – Creation of a roundabout.

1.3.7 Figure 1.3 shows a plan of the proposed improvements in Package 2.

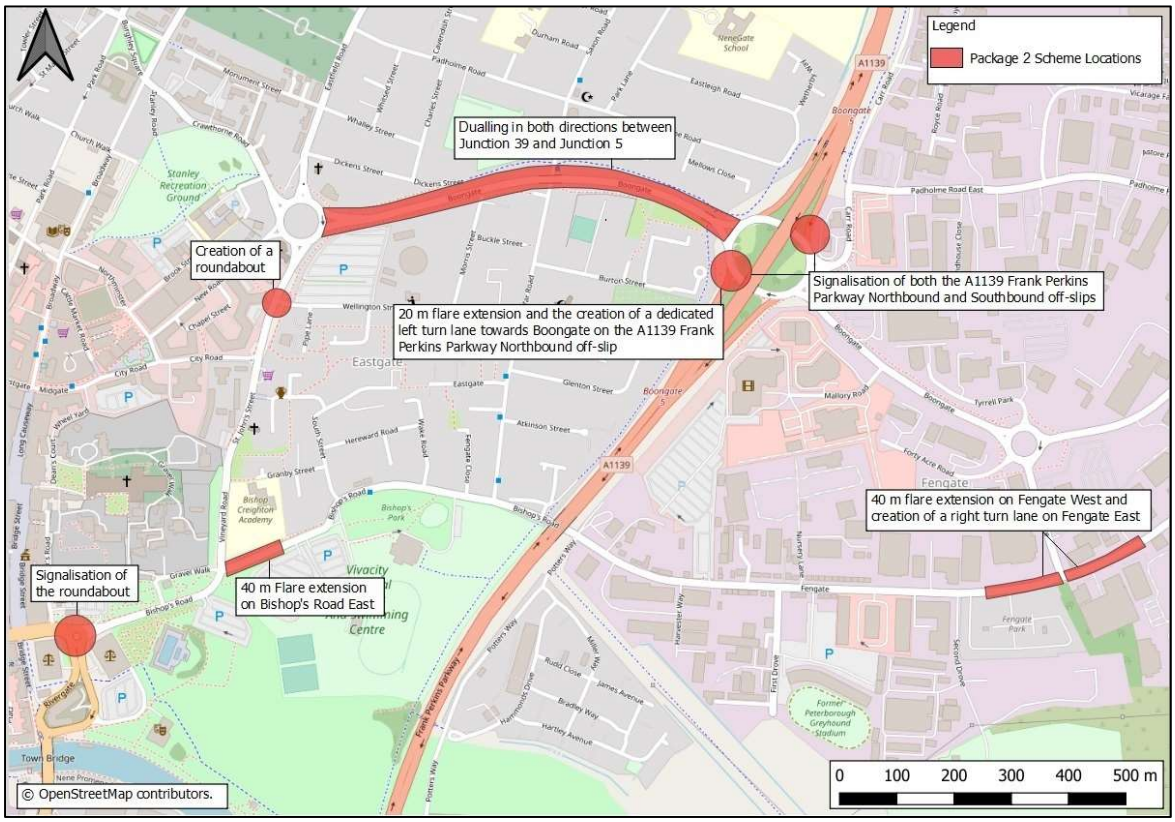

Figure 1.3: Package 2 Improvements

1.3.8 The SOBC demonstrated that both packages met the scheme objectives and reduced existing and future delay at the key junctions in the study area, therefore both Package 1 and Package 2 were considered within the Economic Assessment.

1.3.9 The Economic Assessment demonstrated that Package 1 achieved Very High Value for Money with a Benefit Cost Ratio (BCR) of 5.223. Package 2 achieved Medium Value for Money with a BCR of 1.574. The SOBC concluded that the Value for Money for both packages, especially Package 2, was expected to increase further as additional Economic Assessment and Design work is undertaken at subsequent stages of the Business Case. The Economic Assessment showed that Package 2 provided greater benefits than Package 1, however the cost estimate associated with it at SOBC reduced the BCR.

1.3.10 The SOBC also identified that the appropriateness (and value for money) of both packages are heavily dependent on influences beyond this study, such as the University Planning Application and the Embankment Masterplan, both of which are active workstreams, and assumptions would need to be updated and the impacts reviewed throughout the University Access Study.

1.3.11 A preferred Package could not be determined at the SOBC stage. Potential issues with Package 1 and the operational performance of the highway network directly adjacent to the proposed new northbound off-slip were identified in the Strategic Modelling.

1.3.12 In addition to this, there were changes to a number of the planning assumptions in the study area as the SOBC programme was drawing to a close. The changes included a significant increase in the number of students for the Phase 3 Planning Application University, and the possibility of the Peterborough United Football Ground relocating to the Embankment.

1.3.13 Due to the rapid pace of change of development in the study area, a more detailed assessment of the two packages has been undertaken to better understand the operational impact of the proposed Packages as well as the impact of the evolving strategy for the area, on the appropriateness of both packages. This document reports that detailed assessment of both packages, with the purpose of identifying a preferred option.

1.4 Pedestrian and Cycling Improvements

1.4.1 As part of the SOBC, a Non-Motorised User (MNU) audit was conducted across the study area to review the quality of the existing walking and cycling infrastructure, and to identify improvements to improve active travel provision and reduce severance for non-motorised journeys.

1.4.2 The audit identified the following potential improvements:

- Resurface all footpaths in the immediate vicinity of the Embankment Area, improving accessibility for all users. Resurfacing should reflect that on the most western section of Bishop's Road, where high quality upgrades to surface quality and shared use were implemented in 2018
- Implement controlled crossing points at the off / on slips of Junction 5 (southern side of circulatory) and along the Boongate approach / exit of Junction 39, increasing personal safety and reducing lengthy waiting times for active modes
- Improved lighting on routes which are set back from the roadside, as well as underpasses, improving the perceived safety of these areas.

1.4.3 Figure 1.4 shows the existing walking and cycling routes were identified for improvement within the SOBC. The routes provide key links to the wider walking and cycling infrastructure as well as the car parking sites that will be used by visitors to the Embankment Area.

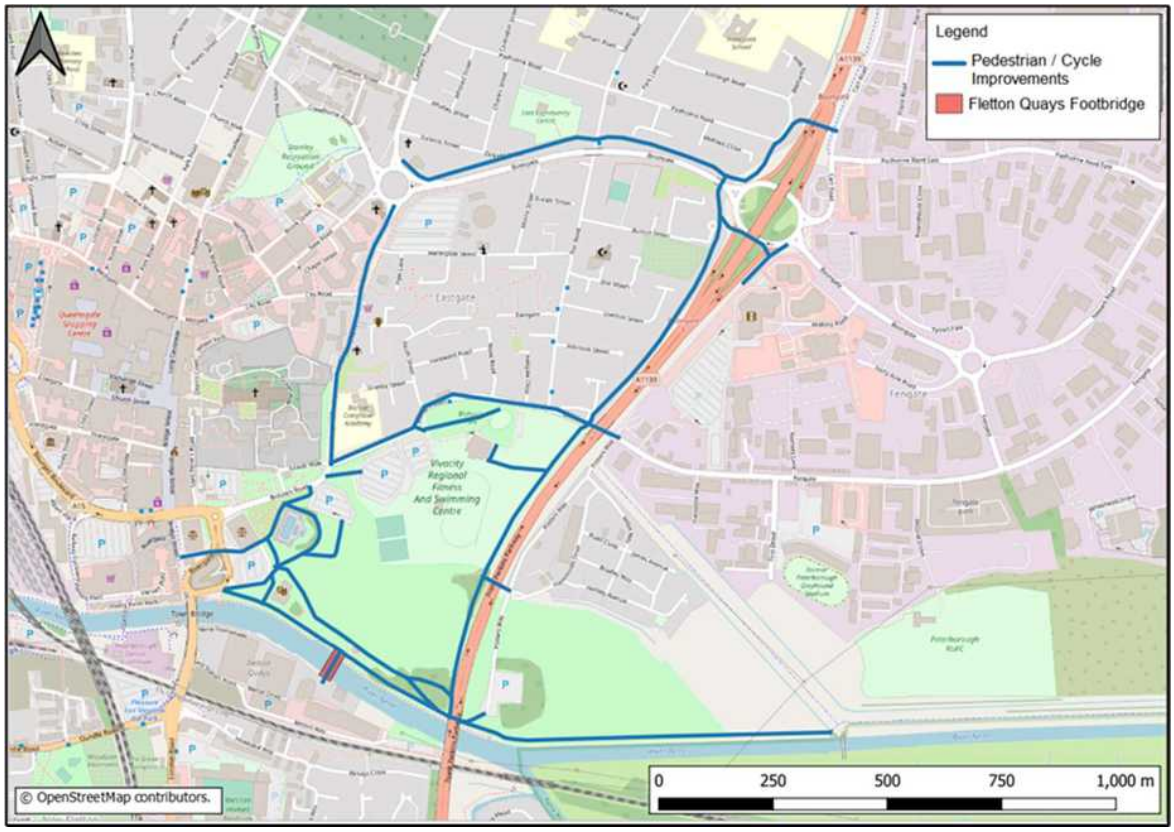

Figure 1.4: Existing Walking and Cycling Routes Identified for Improvement

1.4.4 Additional walking and cycling improvements have also been identified as part of the design development during and are discussed further in Chapter 3.

1.5 Package Assessment

1.5.1 The purpose of this Package Assessment Report is to summarise the further assessment undertaken on both packages, including policy, operational performance, design and construction, and environmental assessments. Public Consultation has also been undertaken with details provided in Chapter 7.

1.5.2 The report concludes by identifying the preferred Package to take forward to Preliminary Design and Outline Business Case.

1.6 Recent Developments

1.6.1 Since the University Access Study SOBC was submitted in December 2020, there have been two significant developments which will impact upon the identification of a preferred package.

1.6.2 The first, is the number of students expected to attend ARU Peterborough by Phase 3. At the time of writing the SOBC, it was assumed to be approximately 6,500 students. However, this has now increased to 12,500 students, and has a significant bearing on the number of trips destined to the Embankment area.

1.6.3 The second development is a change to the assumption in parking locations for the ARU Peterborough. In the SOBC, it was anticipated that there would be a 300-space multi-storey car park on the Embankment, with additional parking provided in a new car park on Potters Way. As part of the Phase 2 planning application, it was agreed that there would be minimal additional on-site parking at the University. The main car park for the Embankment Area, including ARU Peterborough, will be a new multi-storey at Wellington Street.

1.7 Document Structure

1.7.1 The remainder of the document is structured as follows:

- **Chapter 2:** sets out a comparison of how well Package 1 and Package 2 fits with local policy and external influences.
- **Chapter 3:** sets out the concept designs for both packages and provides a description on the key design and construction considerations associated with each scheme.
- **Chapter 4:** sets out the environmental assessment for Package 1 and Package 2.
- **Chapter 5:** compares the operational performance and impact of each package on the highway network in the study area.
- **Chapter 6:** provides an Economic Assessment of each package
- **Chapter 7:** details the public consultation undertaken and provides an assessment of responses received.
- **Chapter 8:** Summarises the Package Assessment Report.

2. Strategic Fit

2.1 Introduction

2.1.1 This chapter sets out a comparison of how well Package 1 and Package 2 fit with key local policy and aspirations for the surrounding area. The SOBC demonstrated how either the concept of a package of improvements at this location had a strong fit with national and regional policy, and so this assessment specifically focuses on how each of the packages aligns with local policy and plans.

2.2 Need for Change

2.2.1 The SOBC identified the factors that are driving the need for change. They come from local growth aspirations, particularly the establishment of ARU Peterborough.

Local Growth Aspirations

2.2.2 Peterborough is forecast to experience significant employment and population growth over the next few decades, reflecting a continuation of past trends. The Peterborough Local Plan (adopted July 2019) sets out the overall vision, priorities and objectives for Peterborough for the period up to 2036. The updated strategy identifies the required delivery of 19,440 new homes and 17,600 new jobs by 20362.

Embankment Area

2.2.3 The City Centre is entering a new and exciting phase in its development, a phase that will deliver significant levels of growth, and the Embankment Area is identified as an opportunity area by Peterborough City Council, and includes proposals for ARU Peterborough, as well as supporting infrastructure such as the Fletton Quays Footbridge, a new pedestrian and cycle bridge connecting Fletton Quays to the Embankment Area.

[2] https://www.peterborough.gov.uk/council/planning-and-development/planning-policies/local-development-plan

2.2.4 ARU Peterborough will deliver an independent, campus-based university. The new University will be fast-growing from 2022 to 2028 (with phased infrastructure)3:

- **Phase 1**: a first university building in Peterborough City Centre from September 2022 with capacity for around 4,000 students
- **Phase 2**: R&D, innovation and incubator expansion. This will centre on Advanced Manufacturing and Materials Research for educational research and development.
- **Phase 3:** growth from 2025 up to around 6,500 students on roll by 2030. It comprises two further teaching focussed buildings, opening in 2025 and 2028, with an associated student union building and infrastructure works to open in 2025.

2.2.5 Phase 1 of ARU Peterborough received planning permission in November 2020 and will be built upon the existing Wirrina car park. A ground-breaking ceremony was held on the 8th of December 2020, with Phase 1 expected to open in September 2022. In addition to this, work us already underway on the Phase 2 Planning Application which is due to be submitted in the next two months. Development of the highway schemes is needed to provide the highway capacity for growth, which is already underway, within this area of the City Centre.

2.2.6 ARU Peterborough has been identified as a key requirement for the north of the CPCA area to improve skills and the economy. In light of COVID-19, and the impact on the economy nationally as well as locally, improving the skills and employability of local people, will be a key component in strengthening the local economy, which will assist with the post COVID-19 economic recovery.

2.2.7 The Need for Change outlined above is the same for both Packages.

2.3 Strategic Fit Assessment

2.3.1 Both Packages have been assessed against relevant local policies and strategies to determine how well they fit with current and future aspirations. The policies and strategies that the packages have been assessed against include:

- Local Transport Plan for Cambridgeshire and Peterborough
- City Centre Transport Vision
- Towns Fund
- Embankment Masterplan
- Active Travel Commitments

3 https://cambridgeshirepeterborough-ca.gov.uk/assets/Growth-Funds/2020.09.22-CSR-University-for-Peterborough-phase-3-final.pdf

2.3.2 An analysis of how well each package meets the policy / strategy objectives is provided beneath and is summarised using a colour coded qualitative scoring system. The scores used are:

- Very Good (dark green) – directly delivers objectives
- Good (light green) – indirectly delivers objectives, or generally supports objectives
- Neutral (amber) – has no positive or negative impact
- Poor (light red) – does not deliver objectives or support objectives
- Very Poor (dark red) – has a significantly detrimental impact on objectives

2.4 Local Transport Plan for Cambridgeshire and Peterborough

2.4.1 In January 2020, the CPCA adopted a Local Transport Plan for Cambridgeshire and Peterborough which replaced the interim Local Transport Plan published in 2017. The plan describes how transport interventions can be used to address current and future challenges and opportunities for Cambridgeshire and Peterborough and sets out the policies and strategies needed to secure growth and ensure that planned large-scale development can take place in the region in a sustainable way.

2.4.2 The objectives of the Local Transport Plan form the basis against which schemes, initiatives and policies are assessed. The objectives of the CPCA Local Transport Plan are:

- **Housing** – support new housing and development to accommodate a growing population and workforce
- **Employment** – connect all new and existing communities so all residents can easily access jobs within 30 minutes by public transport
- **Business and Tourism** – Ensure all of our region's businesses and tourist attractions are connected sustainably to our main transport hubs, ports, and airports
- **Resilience** – build a transport network that is resilient and adaptive to human and environmental disruption, improving journey time reliability
- **Safety** – embed a safe system approach into all planning and transport operations to achieve Vision Zero (zero fatalities or serious injuries)
- **Accessibility** – promote social inclusion through the provision of a sustainable transport network that is affordable and accessible for all
- **Health and Well-being** – provide 'healthy streets' and high-quality public realm that puts people first and promotes active lifestyles
- **Air Quality** – ensure transport initiatives improve air quality across the region to exceed good practice standards

- **Environment** – deliver a transport network that protects and enhances our natural, historic, and built environments
- **Climate Change** – reduce emissions to as close to zero as possible to minimise the impact of transport and travel on climate change.

2.4.3 The Local Transport Plan states that a package of measures will be explored to create and enhance walking / cycling links to ARU Peterborough and improve highway access to the Parkway Network.

Package 1

2.4.4 Package 1, and specifically the provision of the slip road onto Bishops Road, delivers high volumes of traffic onto a low-capacity part of the network that has little scope for additional capacity to be added. This drawback has been exacerbated since the SOBC was produced by the significant increase in student numbers forecast for the later phases of the University. This does not support the objective of building a resilient transport network and improving journey time reliability.

2.4.5 The new northbound off-slip has the potential to impact the setting of Peterborough Cathedral, which is a high value heritage asset. There is also an impact on the biodiversity of the area where the northbound off-slip will be delivered (both of these impacts are discussed further in Chapter 4).

2.4.6 The proposed walking and cycling improvements, including the provision of an underpass under the slip road to maintain walking, and cycling connections, will support the Accessibility and Health and Well-being objectives through the provision of sustainable transport infrastructure and high-quality public realm.

Package 2

2.4.7 The dualling of Boongate provides a high quality and high-capacity link to the northeast transport hub at Wellington Street (which is expected to provide parking for the future growth of the Embankment Area), this supports the objective of building a resilient transport network and improving journey time reliability.

2.4.8 The dualling of Boongate would impact the biodiversity along Boongate, with the removal of trees and shrubs, this would not support the LTP Environment objective. However, replacement planting would form part of the scheme, along with a 20% net gain in biodiversity.

2.4.9 Similar to Package 1, the proposed walking and cycling improvements will support the Accessibility and Health and Well-being objectives. However, the potential walking and cycling improvements that could be delivered in conjunction with redevelopment of the area around Junction 39 would significantly enhance the provision of sustainable transport infrastructure and high-quality public realm in the study area.

Summary

Local Transport Plan	Policy / Strategy Score	Reasons
Package 1	Neutral	• High-volume of traffic on low-capacity road – not building a resilient transport network. • Potential impact to historic and natural environment (mitigation measures would be delivered alongside any scheme). • Walking and cycling improvements support health and well-being and accessibility objectives.
Package 2	Very Good	• Provision of high-quality, high-capacity link – supports a resilient transport network with improved journey time reliability. • Potential to impact natural environment (mitigation measures would be delivered alongside any scheme). • Walking and cycling improvements, especially at Junction 39, support health and well-being and accessibility objectives.

2.5 City Centre Transport Vision

2.5.1 To complement the City Centre development aspirations, a City Centre Transport Vision was prepared to guide future planning policy and provide an ambitious vision that will provide consistency to future development and growth within the City Centre. The vision embraces emerging technologies and a shift in travel behaviour to remove a significant proportion of vehicle trips from the heart of the City Centre. This includes the delivery of multi-functional transport hubs on the periphery of the City Centre, providing the vast majority of City Centre car parking (private and public), and transition points for goods and deliveries destined for the City Centre.

2.5.2 The City Centre Transport Vision also states that as each area of the city centre is planned and regenerated, it should:

- Create high quality Public Realm Corridors from the growth area into the City Centre
- Establish Transport Hubs to replace City Centre parking
- Remove highway capacity and reallocate space for urban realm improvements.

2.5.3 The City Centre Transport Vision is shown in Figure 2.2.

Figure 2.1: City Centre Transport Vision

Package 1

2.5.4 Package 1 delivers high volumes of traffic a low-capacity part of the network that has little scope for additional capacity to be added. This package could work in conjunction with a Transport Hub on the Embankment or in Fengate, but significant issues would still occur in the PM peak as access back onto the Parkway Network would still be via Boongate and Junction 5.

2.5.5 Recent developments in the Phase 2 planning application for ARU Peterborough also confirm that no significant parking will be provided on the embankment site.

Package 2

2.5.6 The dualling of Boongate provides a high quality and high-capacity link directly to the northeast transport hub at Wellington Street (which is expected to provide parking for the future growth of the Embankment Area) and significantly reduces the number of trips on the routes around the Embankment Area.

2.5.7 Package 2 has evolved to further support the City Centre Transport Vision through redeveloping the area around Junction 39, creating significant opportunities to improve walking, and cycling infrastructure, as well as public transport infrastructure.

2.5.8 Given the timing of development and pace of growth on the Embankment, delivery of Package 2 would likely form the first implementation of the City Centre Transport Vision and has real potential to provide the momentum to turn the vision into reality.

Summary

City Centre Transport Vision	Policy / Strategy Score	Reasons
Package 1	Very Poor	• Delivers high volumes of traffic onto low-capacity roads. • Does not provide access back onto the Parkway Network in the PM Peak. • University Parking now confirmed to be off-site.
Package 2	Very Good	• Upgrades Boongate to provide a direct high quality between the Parkway Network and a transport hub. • Redevelopment of the area around Junction 39 creates significant opportunities for improving active travel and public transport provision in the area. • Makes use of existing infrastructure.

2.6 Peterborough Towns Fund

2.6.1 In October 2020, Peterborough City Council was awarded £22.9m from the Government's Towns Fund to support a range of projects in areas such as urban regeneration, planning, land use, connectivity, skills, and enterprise infrastructure to support the planned future growth of Peterborough.

2.6.2 One of the drivers behind the bid was for Peterborough to become a 'walkable' city, making it easier to travel on foot and by bicycle.

2.6.3 A key component of the Towns Fund is 'Riverside Development and Connections' which includes creating a masterplan for the Embankment and designing and building an additional bridge across the river to improve pedestrian and cycle connectivity between the north and south of the city. The Towns Fund will develop the Embankment Area to create a green and accessible place for residents to relax and enjoy leisure and entertainment

Package 1

2.6.4 The provision of the northbound off-slip from A1139 Frank Perkins Parkway has the potential to impact on the built environment of the Embankment Area, with large scale highway infrastructure in an elevated position with a high volume of vehicles travelling down the slip-road and along Bishop's Road.

2.6.5 The proposed walking and cycling improvements will help to achieve the 'walkable city' ambition.

Package 2

2.6.6 Boongate Dualling will have no impact on the proposals for the Embankment Area and will indirectly support the proposals by removing traffic from adjacent roads.

2.6.7 The 'walkable city' ambition will be supported through improvements to walking and cycling infrastructure.

Summary

Towns Fund	Policy / Strategy Score	Reasons
Package 1	Good	• Provision of northbound off-slip may impact on proposals for Embankment. • Walking and cycling connections will meet the 'walkable' city ambition.
Package 2	Very Good	• Boongate Dualling has no impact on Embankment Area proposals and removes traffic from adjacent roads. • Walking and cycling connections will meet the 'walkable' city ambition.

2.7 Embankment Masterplan

2.7.1 To support the redevelopment of the Embankment Area, an Embankment Masterplan is being prepared by Peterborough City Council and is expected to be completed by May 2022. This masterplan will inform the redevelopment that will take place on the Embankment as well as address the need for walking and cycling connections into and out of the site as well as within the site itself. This will include an improved frontage on the River Nene making it an attractive place for residents, worker, visitors to spend time.

Package 1

2.7.2 The delivery of a new northbound off-slip would provide a direct link between the Parkway Network and the Embankment Area. However due to recent planning decisions to minimise on-site parking, vehicles will be required to use low-capacity routes to reach wider City Centre car parking.

2.7.3 The provision of the new off-slip will also reduce the land available for redevelopment at the Embankment Area, and has the potential to impact the type of development that could take place adjacent to the off-slip.

2.7.4 Improvements to walking and cycling connections to the Embankment Area will be delivered on St John's Street, Vineyard Street and Bishop's Road.

Package 2

2.7.5 Package 2 does not impact on the Embankment Area at all in terms of land availability. There would be no impact on type or amount of development that could take place.

2.7.6 The dualling of Boongate will provide a high capacity, high quality route with direct access to car parking facilities at Wellington Street. Walking and cycling improvements to the Embankment Area will be delivered on St John's Street, Vineyard Street and Bishop's Road. In addition, the redevelopment of the area around Junction 39 will enable significant improvements for pedestrians and cyclists at this location.

Summary

Embankment Masterplan	Policy / Strategy Score	Reasons
Package 1	Poor	• Reduces land available for redevelopment. • Improvements to walking and cycling connections.
Package 2	Very Good	• No impact on land available for redevelopment. • Improvements walking and cycling connections to Embankment Area, especially at Junction 39.

2.8 Active Travel

2.8.1 The provision of walking and cycling infrastructure is becoming increasingly critical to all transport schemes, especially with the Government's recent Gear Change strategy and PCC's adoption of LTN 1/20 guidance.

Package 1

2.8.2 Walking and cycling improvements have been identified for Package 1. The improvements will assist in encouraging active travel and provide key connections between the Wellington Street Transport Hub and the Embankment Area.

Package 2

2.8.3 The walking and cycling improvements for Package 2 are almost identical to those in Package 1. However, the potential re-development of the area Junction 39 in Package 2 provides the opportunity to create a significant improvement to walking and cycling in the area. Crossing this large roundabout is currently very difficult for pedestrians and cyclists and serves as a barrier to active travel routes from the north/north-east of the city to the Embankment Area.

Summary

Active Travel	Policy / Strategy Score	Reasons
Package 1	Good	• Walking and cycling improvements will encourage active travel.
Package 2	Very Good	• Walking and cycling improvements identified will encourage active travel. • Re-development of area around Junction 39 creates significant opportunities to improve walking and cycling infrastructure.

2.9 Summary of Strategic Fit Assessment

2.9.1 Table 2.1 provide a summary of the Strategic Fit assessment.

Table 2.1: Strategic Fit Assessment Summary

Policy Area	Package 1	Package 2
Local Transport Plan		
City Centre Transport Vision		
Peterborough Towns Fund		
Embankment Masterplan		
Active Travel		

2.9.2 Table 2.1 demonstrates that Package 2 has a very strong strategic fit with the local policy and growth aspirations.

2.9.3 The dualling of Boongate, provided as part of Package 2, provides a high-capacity and high-quality link from the Parkway Network to the transport hub at Wellington Street (which is expected to provide parking for the future growth of the Embankment Area) and significantly reduces the number of trips on the routes around the Embankment Area.

2.9.4 Given the timing of development and pace of growth on the Embankment, delivery of Package 2 would likely form the first implementation of the City Centre Transport Vision.

2.9.5 Package 1 delivers high volumes of traffic onto a low-capacity part of the network with limited scope for improvement (specifically Bishops Road in Fengate), and this issue has been exacerbated since the SOBC by recent planning assumptions that significantly increase the number of trips associated with the latter phases of ARU Peterborough.

2.9.6 Package 1 could work in conjunction with a Transport Hub on the Embankment or in Fengate, but significant issues would remain in the PM peak as access back onto the Parkway Network would still be via Boongate and Junction 5. In addition, the northbound off-slip could impact redevelopment proposals for the Embankment Area and reduce the amount of land available for development.

2.9.7 Both Package 1 and Package 2 meet walking and cycling objectives within wider policy documents, with improvements identified to improve connectivity to the Embankment Area and encourage walking and cycling trips on as part of a healthy and active lifestyle. Package 2 includes additional proposals for the redevelopment of the area around Junction 39, creating significant opportunities to improve walking and cycling infrastructure, as well as public transport infrastructure in a much needed area of the city.

3. Design and Construction

3.1 Introduction

3.1.1 This chapter sets out the concept designs for both packages and provides a description on the key design and construction considerations associated with each of the schemes.

3.1.2 Package 1 includes the creation of a new northbound off-slip (Junction 4a) from the A1139 Frank Perkins Parkway and Package 2 includes the dualling of Boongate between Junction 5 and Junction 39. Beyond these improvements, both packages contain the same supporting schemes, which are detailed beneath.

3.1.3 It should be noted that the schemes presented beneath have been developed in response to existing issues and to help facilitate future growth. However, there may be a need to re-evaluate and modify improvements in the final package if there is a significant change to assumptions about future growth and development within the study area.

3.2 Package Overview

3.2.1 Each of the packages are introduced in the SOBC and OAR, however some have been updated in recent design work. Each of the packages are outlined beneath.

Package 1

3.2.2 Package 1 consists of the following schemes:

- New northbound off-slip linking the A1139 Frank Perkins Parkway with Bishop's Road (Junction 4a)
- Junction 38 – 40m flare extension on Bishop's Road East
- Junction 5 – signalisation of the A1139 Frank Perkins Parkway southbound off-slip
- Boongate / Fengate Junction – 40m flare extension on Fengate West and creation of a dedicated right turn lane on Fengate East
- St John's Street / Wellington Street – creation of a roundabout.
- Pedestrian and Cycle Improvements – improvements on routes connecting to the Embankment including pedestrian and public realm improvements to St John's Street / Vineyard Road and pedestrian and cycle improvements along Bishop's Road. Also, provision of wider connectivity to Embankment Area, such as Stanground Boardwalk and Charters Pontoon.

3.2.3 Figure 3.1 shows a plan of the proposed improvements in Package 1.

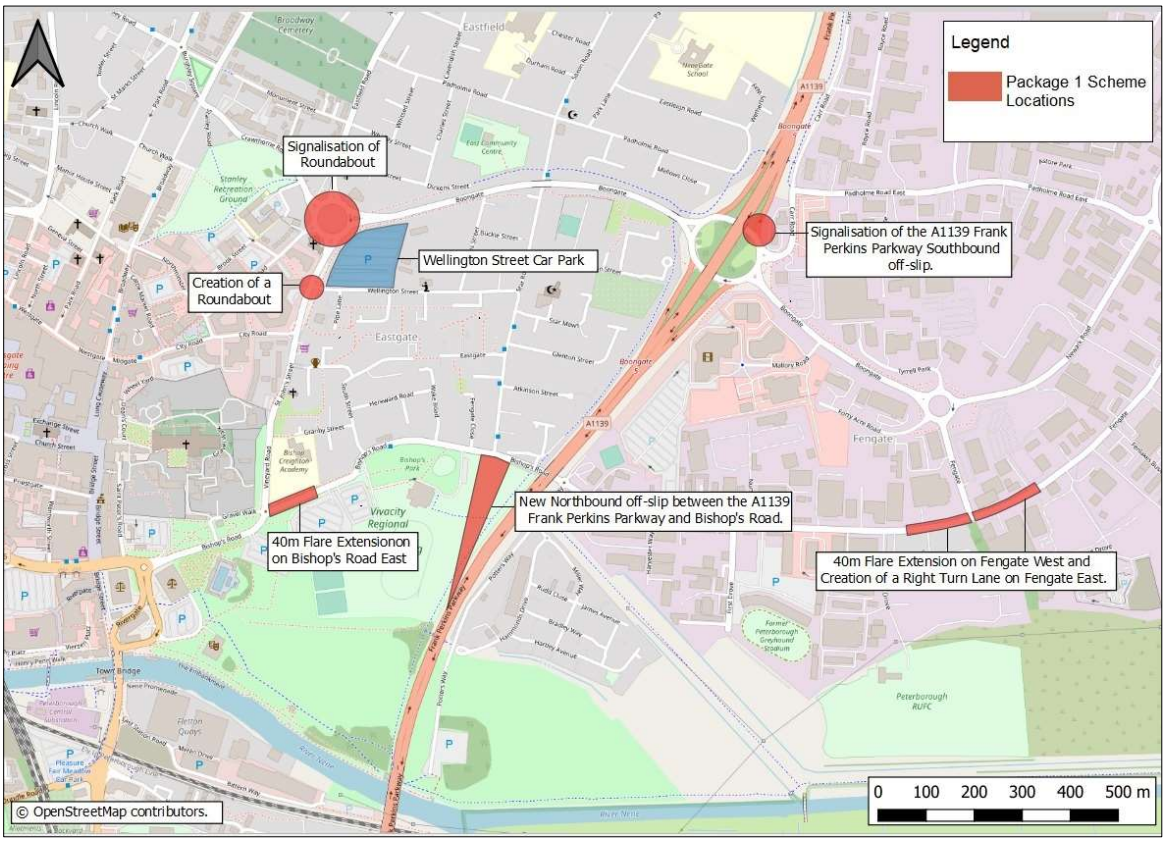

Figure 3.1: Package 1 Improvements

Package 2

3.2.4 Package 2 consists of the following schemes:

- Dualling of Boongate between Junction 5 and Junction 39
- Junction 38 – 40m flare extension on Bishop's Road East
- Junction 5 – signalisation of the A1139 Frank Perkins Parkway northbound and southbound off-slip
- Boongate / Fengate Junction – 40m flare extension on Fengate West and creation of a dedicated right turn lane on Fengate East
- St John's Street / Wellington Street – creation of a roundabout.
- Pedestrian and Cycle Improvements – improvements on routes connecting to the Embankment including pedestrian and public realm improvements to St John's Street / Vineyard Road and pedestrian and cycle improvements along Bishop's Road. Also, provision of wider connectivity to Embankment Area, such as Stanground Boardwalk and Charters Pontoon. Significant walking and cycling improvements to Junction 39 through public realm and provision of crossings.

3.2.5 Figure 3.2 shows a plan of the proposed improvements in Package 2.

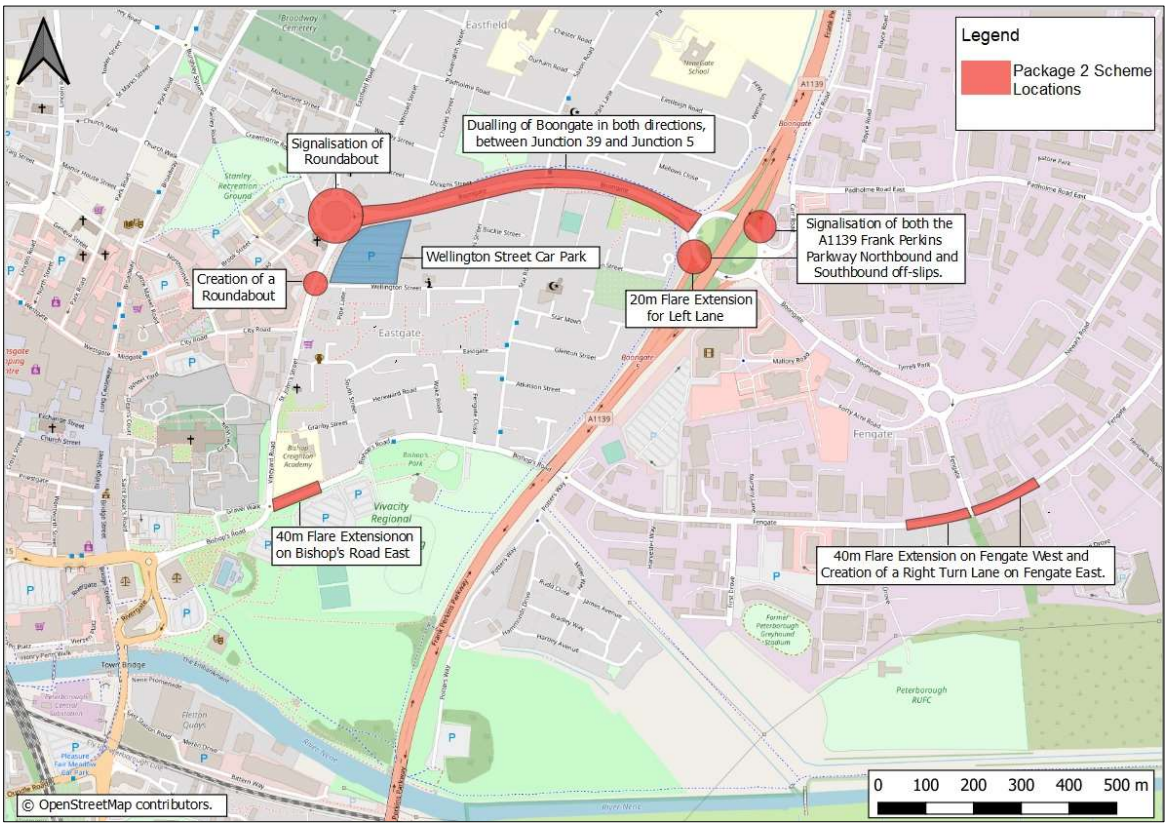

Figure 3.2: Package 2 Improvements

3.2.6 The A1139 Northbound off-slip (Junction 4a – Package 1) and the Boongate Dualling (Package 2) are discussed in greater detail beneath, followed by each of the supporting schemes.

3.3 Design Comments by Scheme

New Northbound Off-Slip (Junction 4a) – (Package 1)

3.3.1 Figure 3.3 shows the concept design for the proposed new northbound off-slip (Junction 4a) from the A1139 Frank Perkins Parkway to Bishops Road. The full concept design drawing is provided in Appendix A.

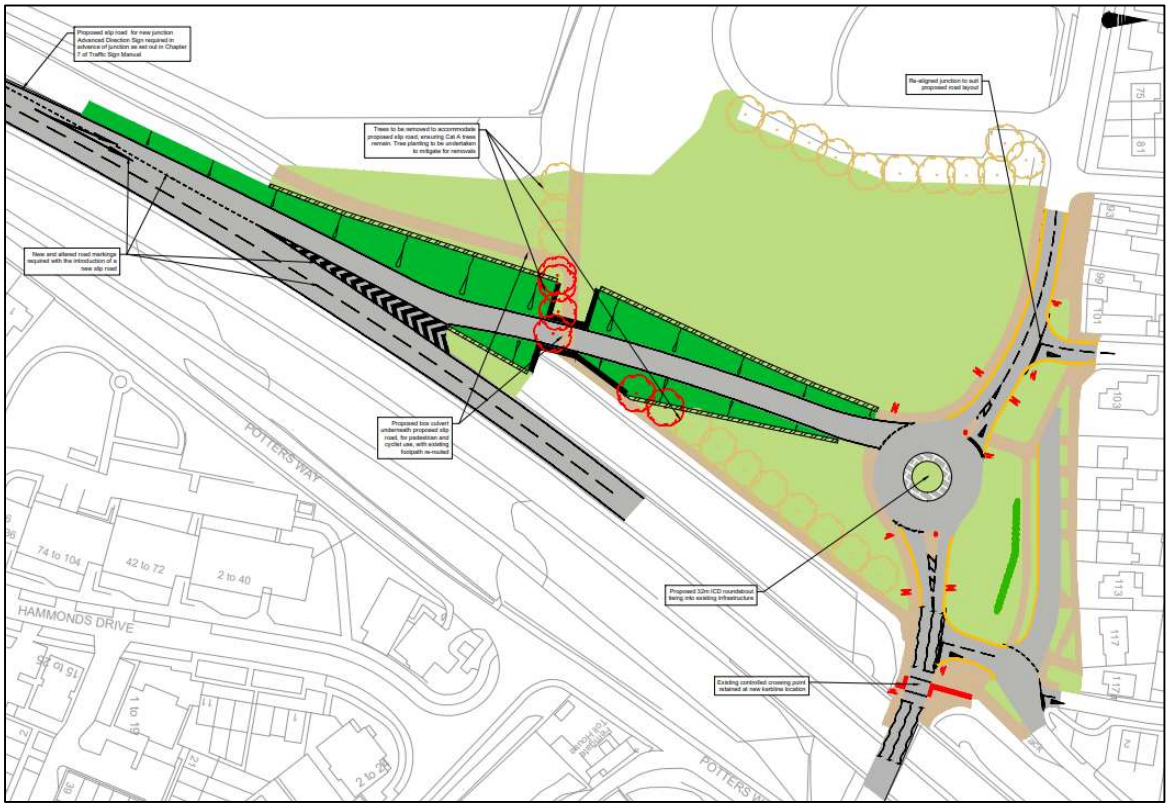

Figure 3.3: Concept Design of New Northbound Off-Slip

3.3.2 The improvement comprises a two lane off-slip from the A1139 Frank Perkins Parkway to Bishop's Road to form a new Junction 4a. Initial design work undertaken in support of the OAR and SOBC confirmed that it was not possible to provide an opposing southbound on-slip due to the existing constraints (including housing) to the east of Frank Perkins Parkway.

3.3.3 A roundabout will connect the new slip road into the existing highway network at Bishop's Road. A new underpass will be included beneath the new slip road to ensure that walking and cycling connections between the City Centre and Fengate are maintained.

3.3.4 The land required to construct the new off-slip is within ownership of the Council and no third-party land is required. There are services including a BT chamber, Virgin media cables and a UKPN high and low voltage cables in the footway along Bishop's Road. Further investigation into the services would be undertaken as part of the preliminary design.

3.3.5 The University Access Study SOBC highlighted the community importance of the ten Corsican Elms running parallel to the A1139 Frank Perkins Parkway. Initially it was thought the provision of a slip road would require all ten trees to be removed. However, the concept design has tried to minimise the impact on the Corsican Elms through realignment of the road, with only two trees requiring removal. Four other trees (of different species) will also need to be removed on the southern side of the recreation area.

3.3.6 The provision of the new off-slip at this location will impact the Bishop's Road recreation area, reducing its size.

3.3.7 Construction of the new northbound off-slip is not considered to be difficult, as much of the slip-road can be built off-line with night-time or weekend closures used for tie-ins at either end.

Boongate Dualling (Junction 5 to Junction 39) – (Package 2)

3.3.8 Figure 3.4 shows the concept design for the proposed dualling of Boongate between Junction 5 and Junction 39. The full concept design is provided in Appendix A.

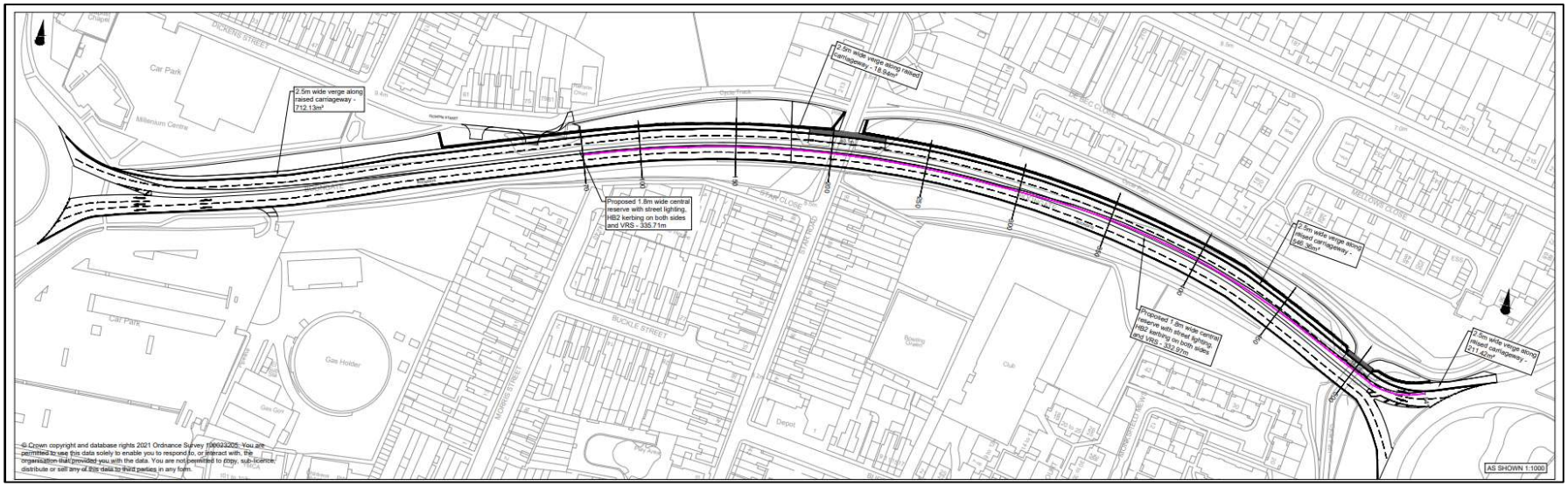

Figure 3.4: Concept Design of Boongate Dualling

3.3.9 The improvement upgrades the existing single carriageway to a dual carriageway between Junction 5 and Junction 39 by widening to the north of the existing road. The Star Road Bridge and the Mellows Close Subway will be widened to accommodate the dualling as part of the scheme.

3.3.10 Mellows Road Subway is a reinforced concrete box structure carrying Boongate over a footway and cycleway to the west of Junction 5. The existing bridge will be widened by approximately 7.8m to the north by removing the existing north edge beam and parapet, then stitching in reinforcement to allow a new reinforced concrete extension to be added

3.3.11 Star Road Bridge comprises a bridge deck made of prestressed beams with in-situ reinforced concrete infill, resting on reinforced concrete abutments with brick cladding. The structure currently carries Boongate as a single two-lane carriageway over Star Road. The existing bridge will be widened by approximately 9.0m to the north by constructing new reinforced concrete abutments on piled foundations adjacent to the existing structure, then demolishing the parapet and existing edge beam to allow additional prestressed beams to be placed over the new abutments and new parapets to be constructed.

3.3.12 A topographical survey was undertaken to inform the concept design of the Star Road Bridge widening. Originally it was thought that a retaining wall would be required along the length of much of the new carriageway, however this has now been limited to the vicinity of the Star Road Bridge based on the survey results.

3.3.13 The land required to construct the dualling is within the highway boundary or Community Related Asset (CRA) land which is controlled by the Council. At this stage, no third-party land is required. There are a number of services within the vicinity of the proposed scheme that will need further investigation at the preliminary design stage, however it is not anticipated that any of these pose a significant risk to the delivery of the scheme.

3.3.14 The dualling of Boongate will bring the edge of the carriageway to within 3.5m of the edge of Dickens Street and will require the turning head on Dickens Street to be relocated. Several parking spaces on Dickens Street may be lost to this relocation, as well as a portion of the tree and shrub belt, requiring complimentary landscaping works to offset the impact

3.3.15 Construction of this scheme can predominantly be undertaken off-line, with no disruption to the existing network. However, Star Road may need closing for a duration whilst the bridge widening works are undertaken. Similarly Mellows Close underpass will also require closure for a potentially lengthy duration. The street lighting will need to be moved to the central reserve once the road is widened, which will require a wider central reservation and therefore more land.

3.3.16 Consideration will need to be given on how best to minimise disruption to a key route into the City Centre from the Parkway Network, and what impacts and constraints are associated with night-time working in an urban area close to residential areas.

Junction 38 Improvements

3.3.17 Figure 3.5 details the concept design for the proposed flare extension on the Bishop's Road (East) approach to Junction 38. The full concept design is provided in Appendix A.

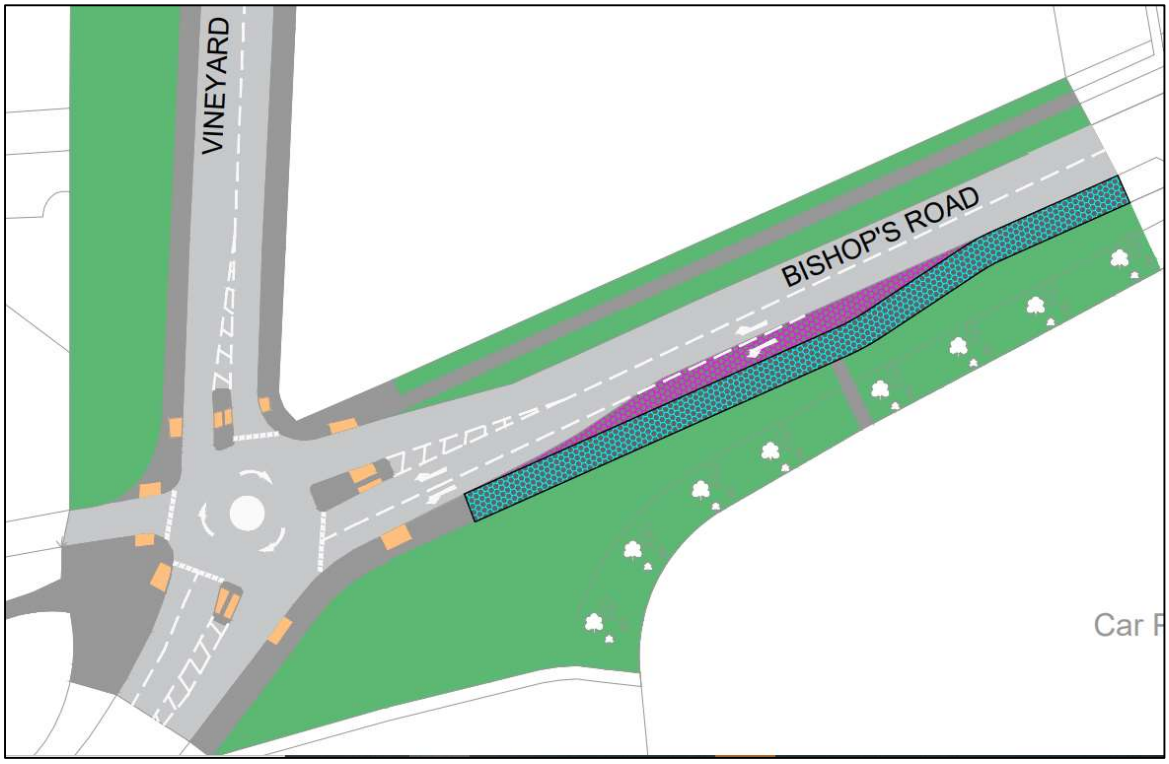

Figure 3.5: Concept Design of Junction 38 Improvements

3.3.18 The Junction 38 improvements consist of a 40m flare extension on Bishop's Road East. The flare will allow for additional stacking capacity at the roundabout for vehicles wishing to turn left into Bishop's Road West. The scheme will also include a re-aligned shared footpath / cycleway along Bishop's Road.

3.3.19 The land required for this scheme is either within the Highway Boundary or CRA land, and no third-party land is required.

3.3.20 There are some services within the vicinity of the scheme that will need to be considered as the design progresses, however they are not anticipated to impact significantly upon the scheme delivery.

3.3.21 Construction of the scheme is considered to be straightforward. Traffic management will be required, and due to its proximity to the City Centre, it is likely to 3-way temporary traffic signals during off-peak hours. Resurfacing is likely to require night-time closure.

3.3.22 Please note that due to its proximity to ARU Peterborough, Junction 38 is very sensitive to proposals in the University Planning Applications and the scheme may need to be revised as proposals for ARU Peterborough evolve.

St John's Street / Wellington Street Junction Improvements

3.3.23 Figure 3.6 shows the concept design for the proposed roundabout at the St John's Street / Wellington Street Junction. The full concept design is provided in Appendix A.

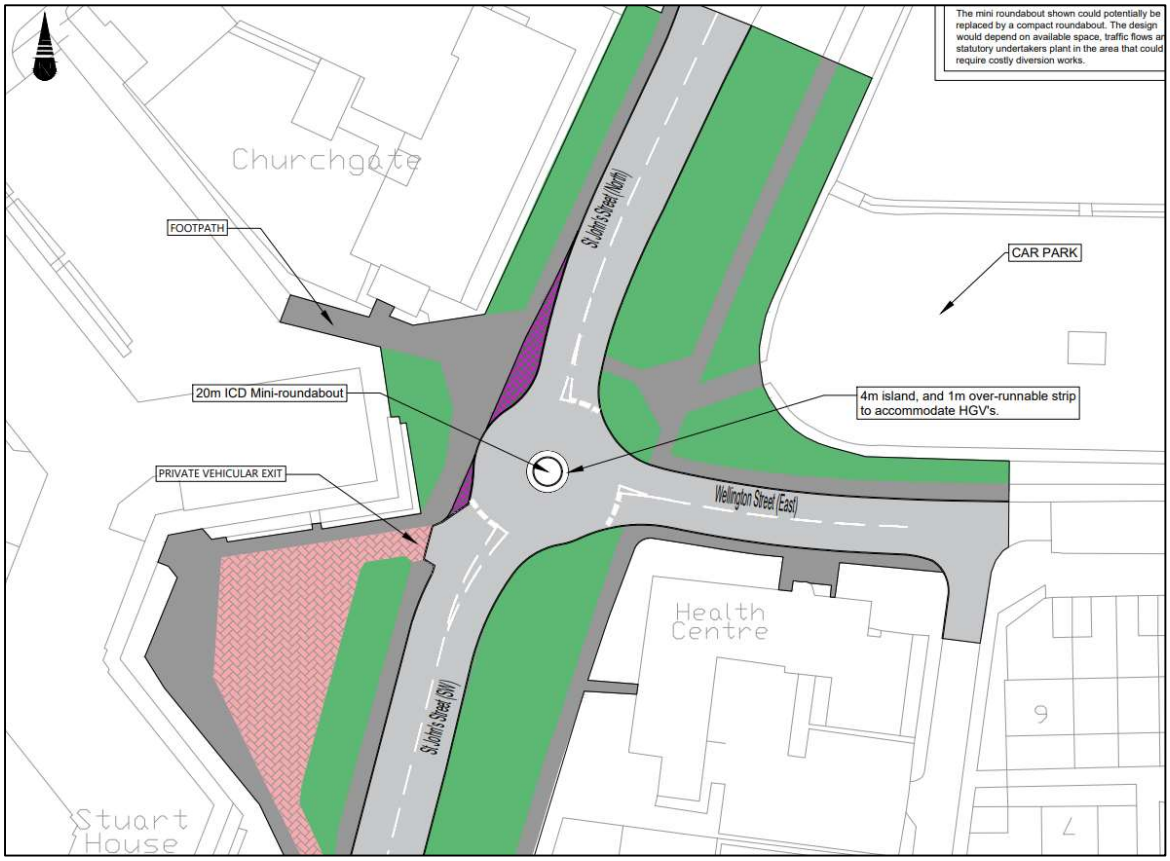

Figure 3.6: Concept Design of St John's Street / Wellington Street Junction Improvements

3.3.24 The proposed improvement at this location consists of converting the St John's Street / Wellington Street Junction to a roundabout

3.3.25 The proposed improvement can fit within the space available, however the roundabout size and approach deflections may not be optimal.

3.3.26 The provision of a roundabout at this location would incorporate crossing facilities for pedestrians and cyclists, the details of these will be carefully considered during Preliminary Design.

3.3.27 One particular issue that will need to be carefully designed is the private vehicular exit from Stuart House which is to southwest of the junction. A right turn ban from this exit may be required. In addition, there are some services within the vicinity of the scheme that will need to be considered as the design progresses, however they are not anticipated to significantly impact upon the scheme delivery.

3.3.28 The operational modelling has shown that the scheme does offer benefit, but some residual queuing remains on the St John's Street northbound approach. Further work will be required as part of the preliminary design to determine whether this can be mitigated given the site constraints. However, this junction is included within the proposals to reconfigure the Junction 39 area (explained beneath) and will be considered as part of that.

3.3.29 Construction of the junction is considered to be straight-forward, however traffic disruption is likely as this route is a key north-south route in the City Centre. Construction will likely require off-peak temporary traffic signals and night-time closures.

Boongate / Fengate Junction Improvements

3.3.30 Figure 3.7 shows the concept design for the proposed improvements to the Boongate / Fengate Junction. The full concept design is provided in Appendix A.

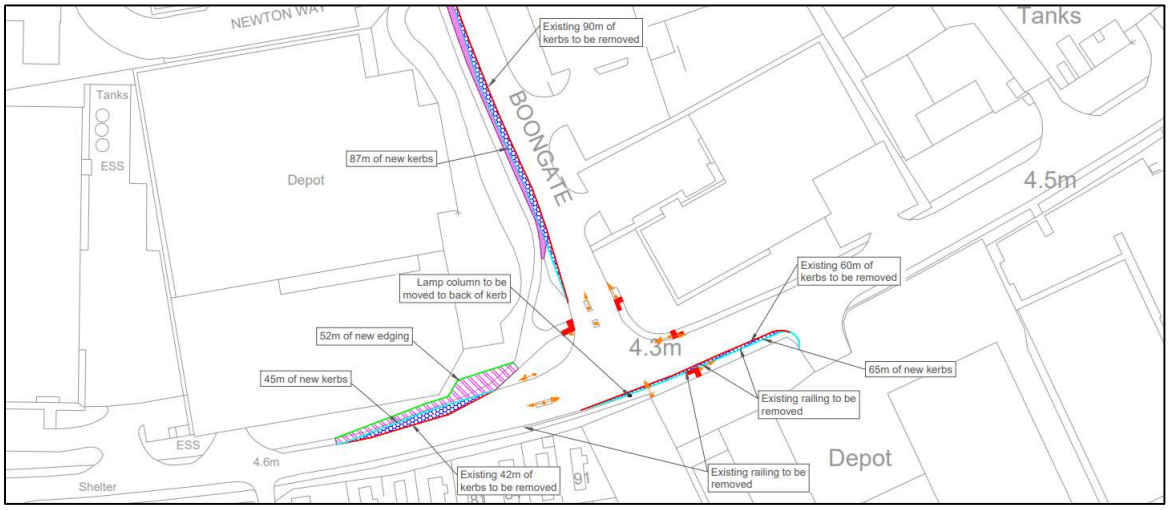

Figure 3.7: Concept Design of Boongate / Fengate Junction Improvements

3.3.31 The improvements to the junction consist of a 40m flare extension on Fengate West and creation of a dedicated right turn lane on Fengate East. In the SOBC, it was stated that a parcel of private land would be required to enable the dedicated right turn lane to be implemented. However further work on the design of this junction has enabled the improvement to be built within the existing highway boundary, removing the need for additional land take on this side of the junction.

3.3.32 On the Fengate West approach, the highway boundary only extends to the rear edge of the footway to the north and third-party land may therefore be required to accommodate both the flare extension and the footway. This will be confirmed at the next stage of the design process.

3.3.33 Services are also present within the vicinity of the junction. It is not anticipated that these will have a significant impact on scheme delivery. Further assessments will be undertaken during preliminary design.

3.3.34 Construction of the scheme is anticipated to be relatively straight-forward, however there will be localised disruption to traffic at this key junction within Fengate. Evening and weekend closures may be required to construct the scheme, alongside off-peak temporary traffic signals.

Junction 5 Improvements

3.3.35 Figure 3.8 shows the signalisation of Junction 5 (as in Package 2). The full concept design is provided in Appendix A. Package 1 only includes the A1139 Frank Perkins Parkway southbound off-slip to be signalised. Package 2 includes the signalisation of both the northbound and southbound off-slips.

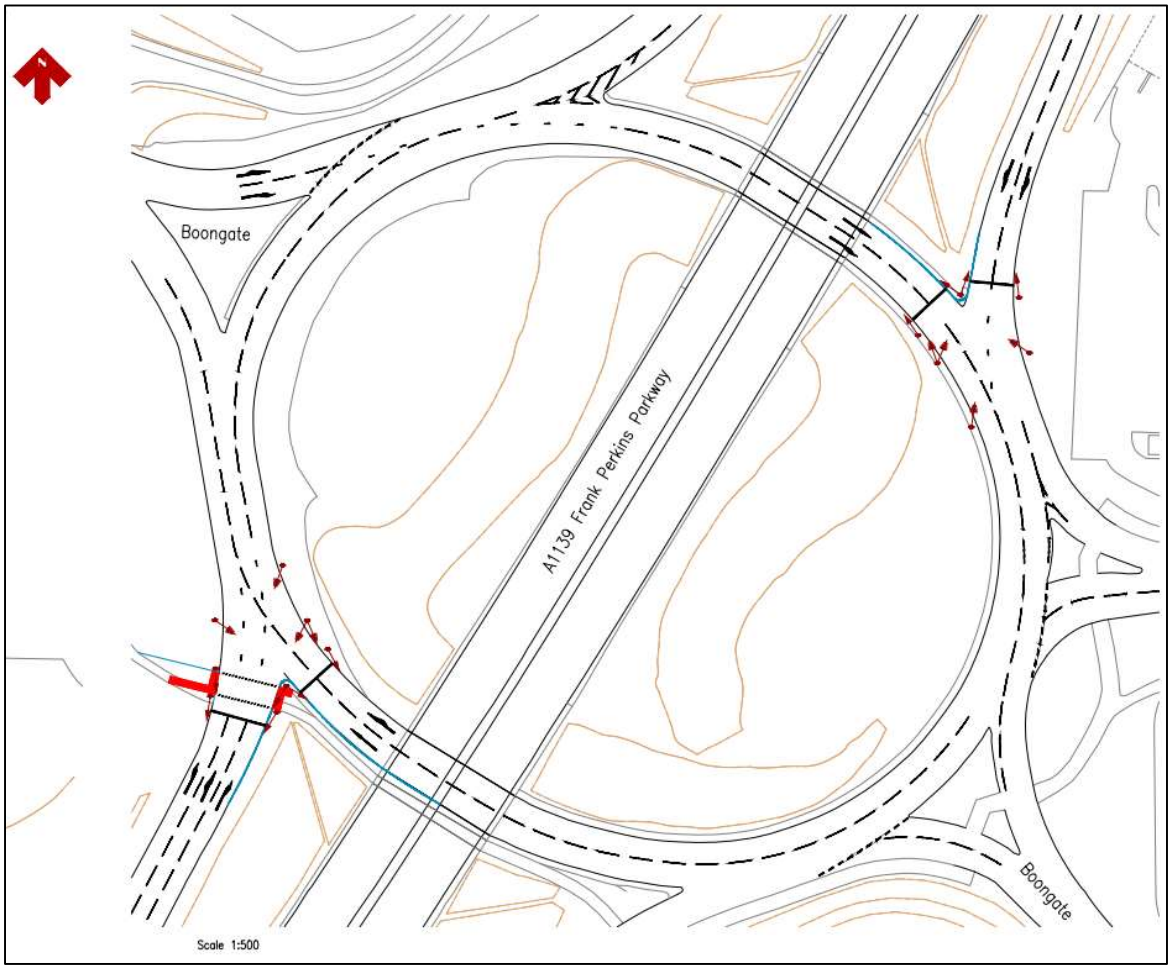

Figure 3.8: Concept Design of Junction 5 Signalisation (As in Package 2)

3.3.36 Further design work has updated proposals for the signalisation of the A1139 northbound off-slip approach to Junction 5 to remove the left dedicated lane that was included in the scheme at SOBC, and instead incorporate the left turn lane into the signalisation at the main junction. The revised three lane approach has been adopted over the left dedicated lane as further design work identified that significant and costly groundworks would be required to support the left dedicated lane, and that it would have a significant impact on tree and vegetation loss.

3.3.37 The phasing of signals has been designed to avoid queues forming onto the A1139 Frank Perkins Parkway, and the signals at the northbound off-slip will provide a formal crossing for pedestrians and cyclists (Package 2 only).

3.3.38 All the land required to deliver these improvements is within the highway boundary. There are known to be services within vicinity of junction, however it is not currently anticipated that these will have a significant impact on scheme delivery.

3.3.39 Delivery of the proposed improvement is considered to be relatively straightforward in construction terms, with weekend slip-road closures likely to be required.

Junction 39 Improvements (Minor Upgrade)

3.3.40 Both Package 1 and 2 include signalisation of Junction 39. This improvement was not included as part of the strategic assessment in the SOBC but has been identified by the operational modelling assessment (discussed later in Chapter 5).

3.3.41 Figure 3.9 shows the concept plan for the proposed junction improvement. The full concept design is provided in Appendix A.

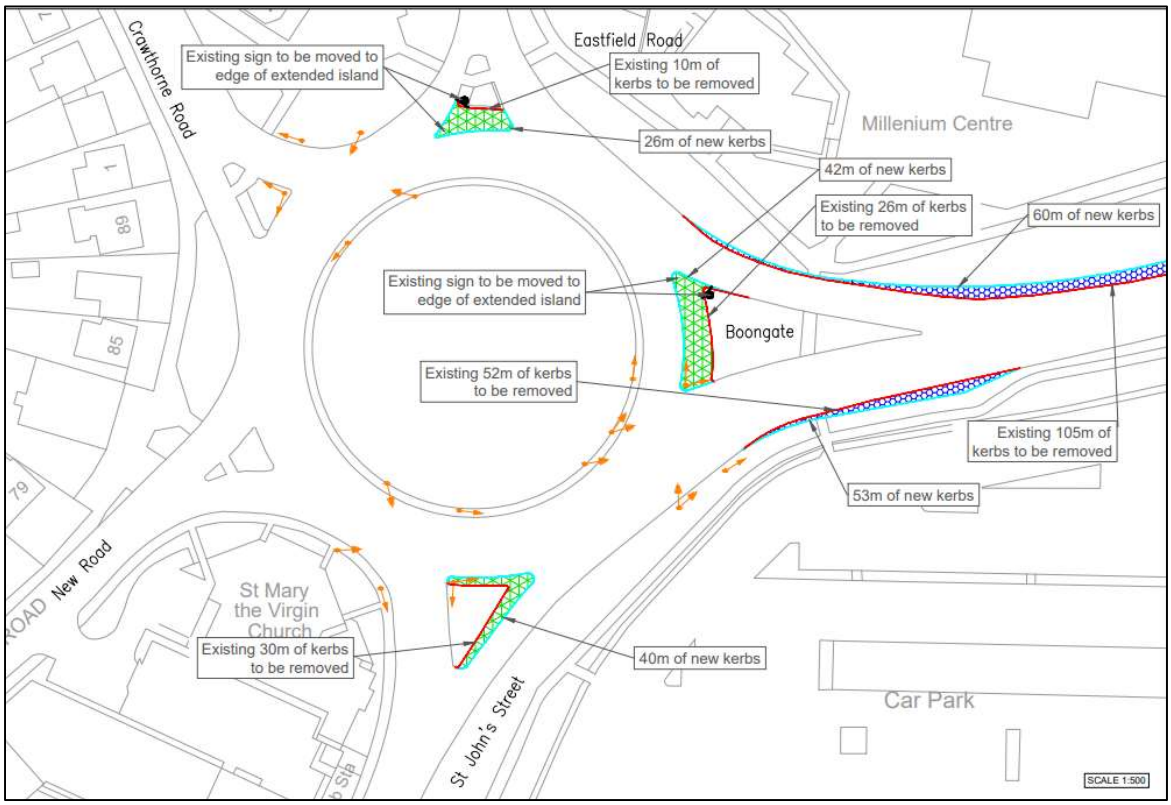

Figure 3.9: Concept Design of Junction 39 Signalisation

3.3.42 Although the signalisation of Junction 39 provides benefits to the operation of junction in both packages, there is still uncertainty on the appropriate junction at St John's Street / Wellington Street to accommodate vehicles exiting the car park. In addition, there is a significant severance caused by the junction for pedestrians and cyclists. Controlled crossings would be provided at the stop lines on approaches, however the provision of controlled crossings on the exits of the junction significantly reduce capacity and reduce the operational efficiency of the junction.

Junction 39 Improvements (Major Upgrade)

3.3.43 In addition to the minor upgrade described above, a much more significant overhaul of the Junction 39 area has been emerged from the current phase of design work. A more significant response to the challenges at this location is needed due to the active travel limitations associated with the existing playout of Junction 39 (which is not significantly altered by the minor upgrade proposals), the operational issues associated with the St John's Street / Wellington Street Roundabout and the increasing opportunity to support the evolving City Centre Transport Vision

3.3.44 Concept proposals for a major of upgrade for Junction 39 have now been developed and the proposal is shown is Figure 3.10 beneath. The intention is to include this proposal as part of Package 2 (replacing the minor upgrade of Junction 39) in the next stage of work (Preliminary Design and OBC).

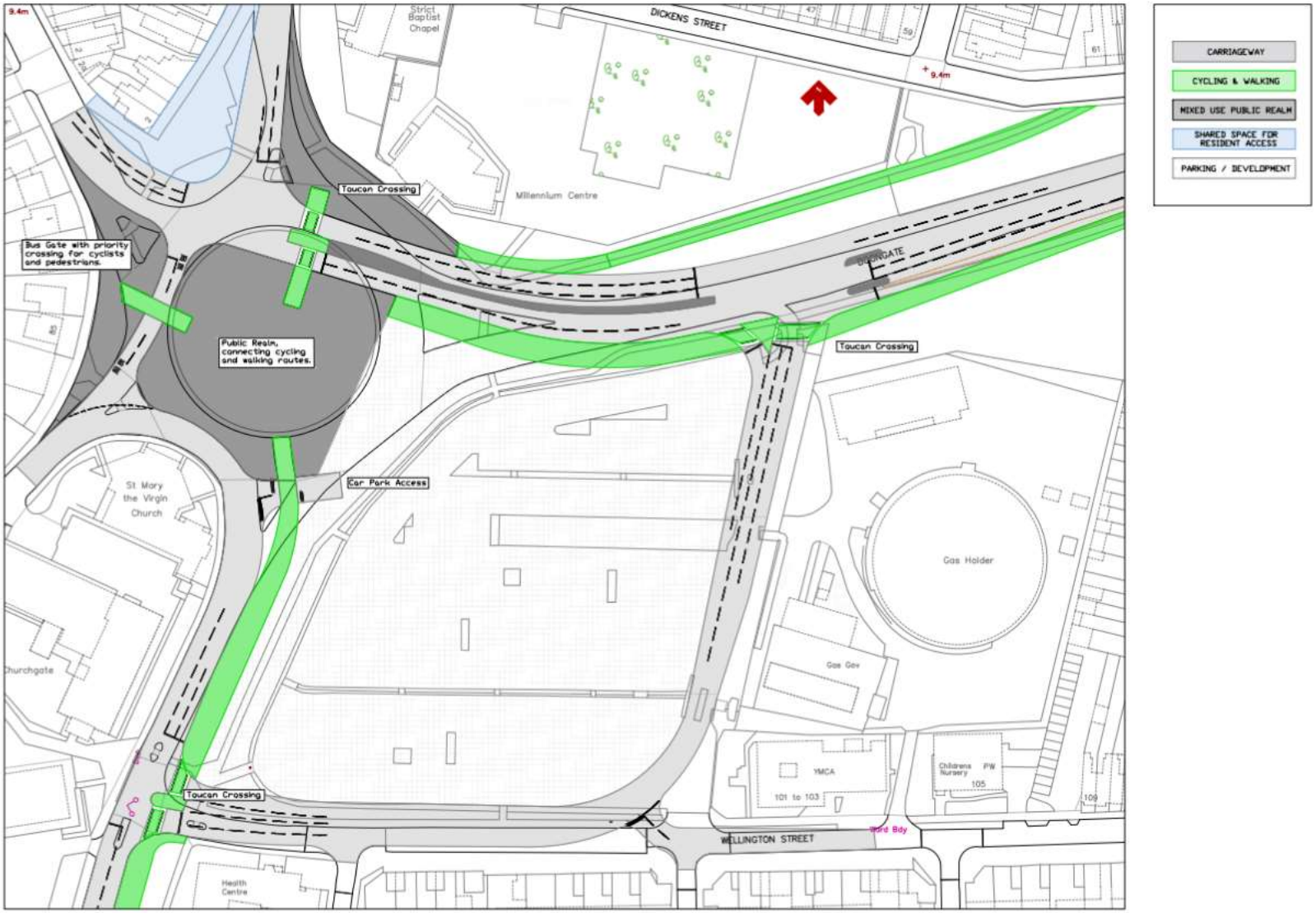

Figure 3.10: Junction 39 Major Upgrade Proposed for Package 2

3.3.45 The proposal for Junction 39 will dramatically change the form of junction and how traffic travels through it. It will accommodate vehicles wishing to enter and exit the car park, reducing the pressure on the St John's Street / Wellington Street junction, and significantly improve provision for pedestrians and cyclists.

3.3.46 Further assessment and design will be required at the next stage to optimise the layout and performance of the junction for all users.

Active Travel Improvements

3.3.47 The University Access Study also includes a range of pedestrian and cycling improvements across the study area. The improvements focus on improving the connections between the Wellington Street Car Park and the Embankment Area as well as improving connectivity to the Embankment from the wider area.

3.3.48 The walking and cycling improvements are discussed in turn below and detailed in Figure 3.11 (in red). Note that the improvements shown in blue are complimentary improvements that are being delivered through other workstreams and are beyond the scope of this project.

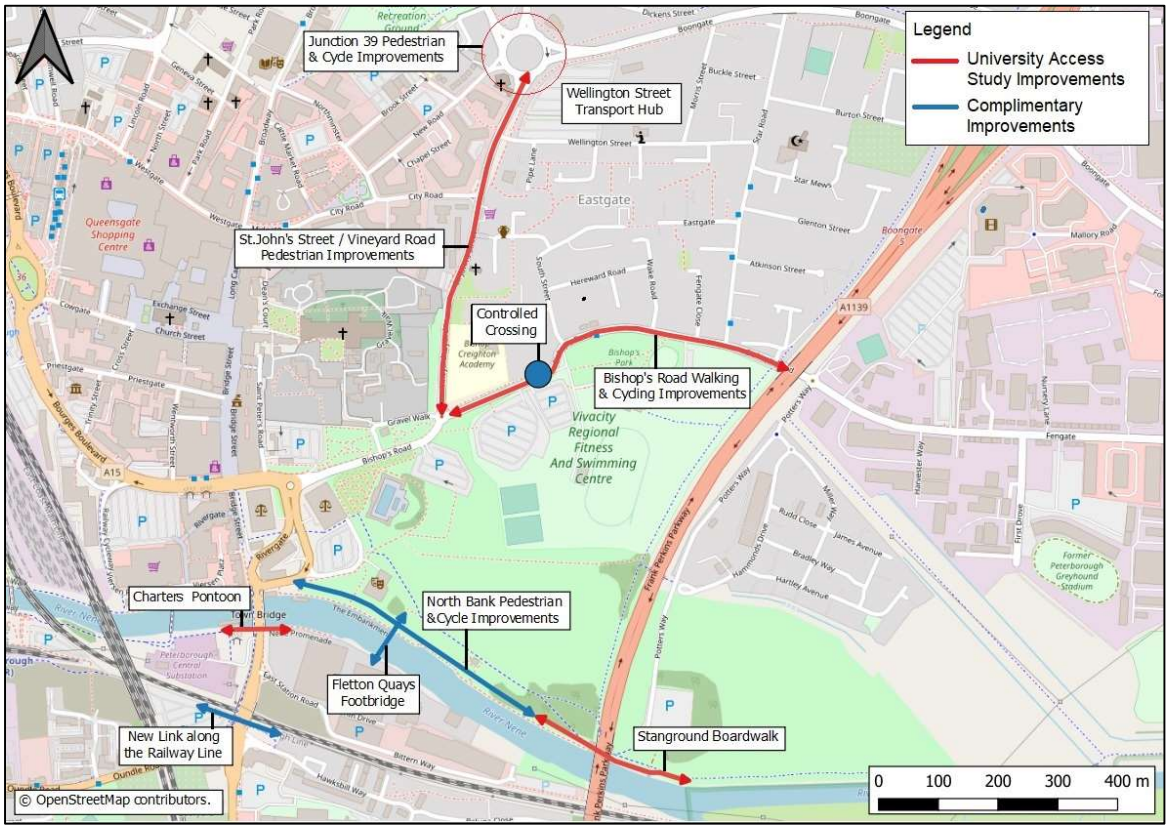

Figure 3.11: Walking and Cycling Improvements in Study Area

3.3.49 Pedestrian improvements are included to the eastern side of St John's Road / Vineyard Road as the key walking route between the Wellington Street Car Park and the Embankment. Improvements will comprise of improving the public realm along the route, as well as surfacing, wayfinding, and removal of street clutter. The public realm improvements will align with the LDA Public Realm Strategy for Peterborough City Centre.

3.3.50 The revised layout of Junction 39 as part of Package 2 will enable significant pedestrian and cycle improvements to be made in the area, particularly with regards to controlled crossing points to overcome the significant levels of severance in the area. Crossing the junction is currently difficult, with a mixture of controlled and uncontrolled crossing points, including an uncontrolled crossing over the three approach lanes of Boongate as shown in Figure 3.12 beneath.

Figure 3.12: Existing Uncontrolled Crossing over Boongate

3.3.51 Bishop's Road between Junction 37 and Junction 38 already has some excellent pedestrian and cycle facilities in the form of a shared-use path, and the improvements proposed will extend these facilities along the southern edge of Bishop's Road between Junction 38 and the A1139 Frank Perkins Parkway Bridge. The improvements will include widening the existing infrastructure, re-surfacing, and wayfinding.

3.3.52 The walking and cycling improvements will also include the Charters Pontoon and Stanground Boardwalk schemes. Both schemes will provide key new connections to the Embankment Area from both the east and west and connect into existing and under-utilised pedestrian and cycling networks.

3.3.53 Charters Pontoon will provide a crucial link under Town River Bridge. At present, pedestrians are required to cross over the A15 London Road, which is a busy route, to continue the walk along the south bank of the River Nene.

3.3.54 Stanground Boardwalk will provide a pedestrian link under the A1139 Frank Perkins Parkway alongside the south bank of the River Nene connecting Stanground with Fletton Quays.

3.3.55 Fletton Quays Footbridge is being developed as part of Peterborough's Towns Fund programme. The provision of the footbridge will provide a key connection between Fletton Quays and the Embankment Area, linking the sites with the wider areas of Woodston, Fletton and Stanground via the pontoon and boardwalk described above. The Towns Fund is also improving the walking and cycling infrastructure along the North Bank of the River Nene, including improved surfacing and lighting as well as installations of public art.

3.3.56 The University of Peterborough Planning Permission secured the implementation of a controlled crossing on Bishop's Road between Junction 38 and South Street.

3.4 Summary

3.4.1 This section has assessed the design and construction of each of the improvements in Package 1 and Package 2. The assessment has shown that there are not considered to be any insurmountable design or construction challenges with either package.

3.4.2 Package 1 includes a two lane off-slip from the A1139 Frank Perkins Parkway to Bishop's Road to form a new Junction 4a. A roundabout will connect the new slip road into the existing highway network at Bishop's Road. A new underpass will be included beneath the new slip road to ensure that walking and cycling connections between the City Centre and Fengate are maintained.

3.4.3 The land required to construct the new off-slip is within ownership of the Council. However, the provision of the new off-slip will impact the Bishop's Road recreation area, reducing its size.

3.4.4 The concept design has tried to minimise the impact on the Corsican Elms through realignment of the road, with only two trees requiring removal. Four other trees (of different species) will also need to be removed on the southern side of the recreation area.

3.4.5 Construction of the new northbound off-slip is not considered to be difficult, as much of the slip-road can be built off-line with night-time or weekend closures used for tie-ins at either end.

3.4.6 Package 2 includes the upgrade of the existing single carriageway to a dual carriageway between Junction 5 and Junction 39 by widening to the north of the existing road. The Star Road Bridge and the Mellows Close Subway will be widened to accommodate the dualling as part of the scheme.

3.4.7 The land required to construct the dualling is within the highway boundary or Community Related Asset (CRA) land which is controlled by the Council. The dualling of Boongate will impact the current turning head on Dickens Street which will require relocation Several parking spaces on Dickens Street may be lost to this relocation, as well as a portion of the tree and shrub belt, requiring complimentary landscaping works to offset the impact

3.4.8 Construction of this scheme can predominantly be undertaken off-line, with no disruption to the existing network. However, Star Road may need closing for a duration whilst the bridge widening works are undertaken. Similarly Mellows Close underpass will also require closure for a potentially lengthy duration. The street lighting will need to be moved to the central reserve once the road is widened, which will require a wider central reservation and therefore more land.

3.4.9 Consideration will need to be given on how best to minimise disruption to a key route into the City Centre from the Parkway Network, and what impacts and constraints are associated with night-time working in an urban area close to residential areas.

4. Environmental Assessment

4.1 Introduction

4.1.1 This chapter sets out the environmental assessment for Package 1 and Package 2. The environmental assessment has been focused on the significant new pieces of infrastructure in each package: the new northbound off-slip (Junction 4a) in Package 1; and the dualling of Boongate in Package 2 and will assist with determining the preferred option from an environmental perspective.

4.2 Environmental Assessment

4.2.1 An Environmental Appraisal has been completed for each of the following areas:

- Air Quality
- Archaeology and Cultural Heritage
- Landscape and Visual
- Biodiversity
- Noise and Vibration
- Water: Hydrology and Drainage
- Socio Economic and Community Impacts
- Socials and Geology.

4.2.2 The findings for each area are summarised in this Chapter. The full Environmental Assessment Report is included in Appendix B.

4.2.3 There are a number of interrelationships between the different environmental areas. For example, the historic environment and landscape in relation to the effects on the setting of built heritage assets, and biodiversity and water in relation to the effects on freshwater and intertidal habitat. Where there are interrelationships, they have been considered and reported in line with the appropriate guidance to prevent double counting of effects.

4.2.4 For each environmental area discussed below, baseline environmental conditions and constraints have been discussed, alongside operational and construction impacts. A Red Amber Green (RAG) system has been used to assess each environmental area to assist in determining environmental issues from the outset and ensure potential issues are appropriately addressed.

4.2.5 Table 4.1 presents the criteria have been used to determine the RAG ratings for individual environmental topics.

Table 4.1: RAG Criteria for Environmental Assessment

RAG Rating	Criteria for each rating
Red	A Red rating is for those environmental areas in which overall environmental effects (during construction and/ or operation phases) are likely to be significantly adverse, and which would be difficult to mitigate sufficiently (i.e., significant residual effects would be likely).
Amber	An Amber rating has been given to environmental areas where overall effects (during construction and/ or operation phases) would be potentially significant adverse but can be appropriately mitigated.
Green	A Green rating has been attributed to environmental areas where overall effects (both construction and/ or operation phase) are likely to be either Neutral or Beneficial (Slight, Moderate or Major) based on the current design.

4.2.6 The risk rating is preliminary and will need to be reviewed following more detailed environmental assessments. Once the preferred Package has been identified, it could be subject to a Planning Application under the Town and Country Planning Act 1990 (as amended). To support any Planning Application, further environmental assessment would be required for those environmental topics where there is potential for environmental effects.

4.3 Air Quality

4.3.1 There are no Air Quality Management Areas (AQMAs) within a 2km of the proposed northbound off-slip or Boongate Dualling.

Operational Impacts

4.3.2 Residential receptors located within 200m of the potential sites may experience a permanent benefit in terms of air quality impacts, although other roads may experience adverse effects.

4.3.3 Consideration for the wider area should also be given when assessing air quality and as such, the proposed car park has the potential to result in a reduction in traffic entering the City Centre and could therefore improve the air quality within the city.

4.3.4 At this stage in the assessment of each of the Packages, the overall effects upon Air Quality are difficult to determine. However, a full assessment of the potential effects upon Air Quality receptors, will be completed as part of the preliminary design, which will take account of air quality monitoring data and traffic data.

Construction Impacts

4.3.5 Construction plant and machinery have the potential to temporarily reduce air quality at nearby receptors, through emissions of nitrogen oxides (NOx), particulates (PM10 and PM2.5) and other combustion related pollutants. The likely duration of works and traffic management arrangements are still to be finalised but could influence mitigation requirements during construction.

4.3.6 Adverse effects resulting from dust emissions may also occur however the employment of good practice measures would reduce adverse effects. Assuming works are carried out in accordance with best practice and a Construction Environmental Management Plan is strictly implemented overall effects are likely to be 'Slight Adverse'.

RAG Rating

4.3.7 An Amber rating has been given for Air Quality for both proposed northbound off-slip or Boongate Dualling. Overall effects are likely to be 'slight adverse' during construction. Operational effects have the potential to be 'slight adverse due to additional traffic flow on the highway network.

4.3.8 At this stage in the assessment of options, it is not considered likely that there would be a substantial difference in the likely Air Quality effects between the two proposed options.

4.3.9 Further assessment will consider the impact of the preferred option at preliminary design stage.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Air Quality		

4.4 Archaeology and Cultural Heritage

4.4.1 There are no Scheduled Monuments within 1km of either the northbound off-slip or Boongate Dualling. There are no registered Parks and Gardens or Registered Battlefields within 1km of the proposed options.

4.4.2 Both the northbound off-slip or Boongate Dualling are within 1km of Peterborough City Conservation Area. The conservation area has a number of key landmark buildings including the Cathedral, the Guildhall, and the Church of St John the Baptist.

Operational Impacts

4.4.3 The new northbound off-slip has the potential to impact the setting of high value heritage asset, Peterborough Cathedral. Further design would need to be informed by a heritage assessment on the impacts on views to/from the Cathedral.

4.4.4 The dualling of Boongate is unlikely to affect the long-term viability of designated cultural heritage resources given the current highway setting.

Construction Impacts

4.4.5 The new northbound off-slip has an increased potential for unearthing unknown archaeological remnants within the greenbelt areas traversed by the site. Therefore, appropriate measures such as an archaeological watching brief or archaeological recording would be required to ensure any impact on archaeology can be appropriately mitigated.

4.4.6 Boongate Dualling is anticipated to have little potential for unearthing unknown archaeological remnants within the greenbelt areas traversed by the site.

4.4.7 For both options, strict implementation of a Construction Environmental Management Plan will be required during construction.

RAG Rating

4.4.8 Overall, the effects during construction at both sites would be significant with the potential for unknown archaeological finds to be uncovered and damaged during construction.

4.4.9 The new northbound off-slip has the potential to impact the setting of nearby designated assets such as Peterborough Cathedral. A thorough assessment of the impact would need to be undertaken as part of any further design work to take account of the significance of the scheme on the heritage in the area. The northbound off-slip has a red rating due to the potential higher risk to archaeology and cultural heritage during delivery of the scheme.

4.4.10 An amber rating has been attributed to Boongate Dualling.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Archaeology and Cultural Heritage		

4.5 Landscape and Visual Impact

4.5.1 There are no Areas of Outstanding Natural Beauty (AONB) or National Parks within the study area. The dominant pattern of the landscape at the proposed northbound off-slip and at Boongate comprises of areas of residential and commercial buildings, amenity grassland, vegetation and hard standing (associated with the existing road network).

4.5.2 Numerous visual receptors are located within both options theoretical Zone of Visual Influence.

Operational Impacts

4.5.3 Both proposed options have the potential to permanently alter the landscape character of the surrounding area through a perceptible visual increase in the area of hardstanding and the addition of above ground infrastructure such as street lighting.

4.5.4 Visual impacts are likely to be unavoidable given the varied elevation of the surrounding area and locations of proposed options.

4.5.5 The new northbound off-slip would be in an elevated position with prominent views from the city and surrounded by mature vegetation. Well-established Corsican Elm Trees may be affected by the proposals and therefore detrimental visual effects for a number of receptors may be unavoidable until reinstatement screening vegetation has matured (approximately 15 years).

4.5.6 There is also potential for visual impacts at night with the installation of new street lighting as part of either option. However, it may be possible to remove existing street lighting close to residential properties along Boongate as part of the dualling scheme (Package 2) due to changes to the Council's street lighting policy since the original infrastructure was installed. This would need to be confirmed through further highway design and road safety work. The northbound off-slip would need to be lit as it forms the approach to a junction (within 100 metres).

4.5.7 Given the urban nature of sites, and the presence of road and communications infrastructure within the locality, the tranquillity of the local area is not anticipated to be affected any further by the proposed options. Mitigation measures such as replanting would reduce permanent effects for many receptors in the long term.

4.5.8 Overall, given the high value local and surrounding landscape, the presence of numerous high value receptors, Peterborough Cathedral and the permanent installation of above ground infrastructure associated with both options, there is potential for significantly adverse landscape character and visual operational impacts on receptors without adequate mitigation. This would need to be fully developed as part of the Landscape and Visual Impact Assessment of the preferred option. This will need to consider if mitigation measures such as temporary or permanent fencing or screening may be necessary.

Construction Impacts

4.5.9 The presence of construction machinery, plant and stockpiling of materials would be likely to adversely impact upon the landscape character of the surrounding area.

4.5.10 Temporary changes to the landscape are considered to be unavoidable as a result of either option during the construction period, particularly given the varied elevation within the area. The clearance of vegetation during construction is likely to open-up views of the works area and would result in visual impacts on numerous receptors (high value receptors include residential properties and Parkland).

4.5.11 Vegetation clearance and construction machinery would also be visible from Peterborough Cathedral during construction of the new northbound off-slip which would be likely to result in adverse effects on landscape character for a temporary period. An effective mitigation strategy to minimise effects through screening and minimising the storage of materials for example would need to be developed.

RAG Rating

4.5.12 An Amber rating has been attributed to Landscape and Visual Impact. Overall, effects during construction and operation have potential to be 'significant adverse' for both the proposed northbound off-slip and Boongate Dualling. However, given the context of the location and with appropriate mitigation measures and enhancements put in place, it is anticipated that these adverse effects can be reduced through appropriate mitigation. At this stage in the assessment of options, it is not considered likely that there would be a substantial difference in the likely landscape and visual effects between either of the proposed options. Therefore, both the northbound off-slip and Boongate Dualling have been assigned an amber rating.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Landscape and Visual Impact		

4.6 Biodiversity

4.6.1 The are no statutory designated sites for nature conservation within the study area. No Special Protection Areas, Ramsar or National Nature Reserves have been identified within the vicinity of the proposed options.

4.6.2 The Nene Washes Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI) is located approximately 1.2km south of each option at its closest point.

4.6.3 None of the sites contain ancient woodland.

Operational Impact

4.6.4 Operational impacts resulting from both the northbound off-slip and Boongate Dualling are likely to include the potential loss of habitat for bats and breeding birds.

4.6.5 Therefore, there is potential for habitat creation and enhancement to be a requirement for either option, to ensure that the overall project achieves a net biodiversity gain (which is in line with local and national policy). Assuming this mitigation and / or enhancement measures are put in place, overall effects on protected species and habitats are likely to be minimised.

Construction Impact

4.6.6 There is potential for adverse effects upon protected species, in the absence of mitigation, on bats and breeding birds with the requirement for removal of vegetation and mature trees, as well as disturbance from temporary construction machinery and lighting. Targeted ecological surveys for protected species would need to be undertaken in advance of the works of either option which would inform any licence that may be required (should protected species be confirmed at the site).

4.6.7 With appropriate mitigation and enhancement measures, and with works undertaken at an appropriate time of year (which would minimise effects to relevant protected species, if present), overall effects on nature conservation are likely to be minimised.

4.6.8 The area adjacent to both the proposed northbound off-slip and Boongate Dualling support foraging and commuting bats, and therefore night-time working or lighting during the construction phase should carefully consider how to minimise potential disturbance.

RAG Rating

4.6.9 An amber rating has been attributed to Biodiversity for both the proposed northbound off-slip and Boongate Dualling. Overall, effects during the construction and operation phases have the potential to be significantly adverse. However, with appropriate mitigation and enhancement measures put in place, adverse effects are likely to be reduced.

4.6.10 From an ecological perspective and based on the findings from the ecological work undertaken to date, it is considered that Option 1 would be more ecologically favourable than Option 2. However, at this stage of the assessment it is not considered likely that there would be a substantial difference in the likely impacts upon nature conservation features between the proposed options. Therefore, both the northbound off-slip and Boongate Dualling are considered to be amber.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Biodiversity		

4.7 Noise and Vibration

4.7.1 Residential properties, places of worship, schools and numerous commercial dwellings have been identified within 500m of the proposed sites.

Operational Impact

4.7.2 Both of the proposed options would be likely to result in a change in noise and vibration levels, through the presence of numerous sensitive receptors within close proximity once built. through the presence of numerous sensitive receptors within close proximity of the scheme. Therefore, monitoring of the baseline noise and vibration levels within the study area would be necessary to ensure operational noise and vibration levels are adequately assessed.

4.7.3 With appropriate mitigation, potentially including acoustic fencing or bunds or secondary glazing for adversely effected properties, the overall effects are likely to be minimised.

Construction Impact

4.7.4 Numerous sensitive receptors are located within close proximity of both the proposed northbound off-slip and Boongate Dualling. They are both likely to alter noise and vibration baseline levels during construction, through construction activities and the presence of construction machinery and vehicles, although the varied topography of the area is likely to have implications on the noise conditions at receptors.

4.7.5 The effect upon the noise environment for sensitive receptors would be dependent on the type of construction plant involved, time of day in which works will be undertaken and the duration of works. Measures setting out noise restrictions will need to be agreed through consultation with the local authority prior to construction. At this stage in the assessment of options, the overall effects upon noise sensitive receptors are difficult to determine.

4.7.6 However, a full assessment of the potential Noise and Vibration effects would be completed for the preferred option, which will include appropriate mitigation requirements.

4.7.7 Strict implementation of the CEMP during construction would be required, and acoustic barriers may be required to protect properties within very close vicinity.

RAG Rating

4.7.8 There is the potential for either scheme to result in significant effects during construction and operation. However, with appropriate mitigation put in place adverse effects are likely to be reduced to an acceptable level (through the provision of noise barriers, secondary/double glazing, and low noise surfacing).

4.7.9 At this stage in the assessment of site options, it is not considered likely that there would be a substantial difference in the likely impacts upon the noise and vibration environment for sensitive receptors between any of the proposed sites. Therefore, both Package 1 and Package 2 are therefore considered to be Amber.

4.7.10 Further assessment will be undertaken as part of the preliminary design of the preferred option to understand the impact and any mitigation measures that will be required in during the construction and operational phases.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Noise and Vibration		

4.8 Water Environment: Hydrology and Drainage

4.8.1 The study area for the appraisal was defined as the area of each option and any surface water features, groundwater features or water dependent designated sites located up to 0.5km from the site. Both the proposed northbound off-slip and Boongate are located in Flood Zone 1.

There are no key surface water features or designated sites within the study area.

Operational Impacts

4.8.2 Both the proposed northbound off-slip and Boongate Dualling would result in an increase in hardstanding (and impermeable area) which has the potential to increase the risk of flooding. Alteration to flow characteristics could impact upon the geomorphology of the surrounding surface water drains that may affect channel erosion and deposition processes. A Flood Risk Assessment (FRA) would be required for the preferred option.

4.8.3 The use of Sustainable Drainage Systems (SuDs) should be used where possible. Overall long-term effects are likely to be minimised if mitigation measures and drainage are designed to ensure there will be no additional flood risk from surface water runoff.

Construction Impacts

4.8.4 Although the aquifer at depth is in an area of medium-high groundwater vulnerability, proposed activities are confined to surface strata and as such there is limited connectivity and no pathway for significant risk to occur. Mitigation measures outlined within a CEMP will further prevent any adverse impact on key features.

RAG Rating

4.8.5 A green rating has been attributed to water environment. Both the proposed northbound off-slip and Boongate Dualling were considered to have an assessment score of neutral because they have no appreciable effect on the identified features. The risk to water quality and biodiversity of the surrounding surface water features is low. All watercourses are artificial drains and have low geomorphological and ecological value.

4.8.6 An increase in hardstanding (and impermeable area) which has the potential to increase the risk of flooding. Operational drainage will be designed to ensure there will be no additional flood risk from surface water runoff.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Water Environment: Hydrology and Drainage		

4.9 Socio-Economic and Community Impacts

4.9.1 Local communities are present within the vicinity of the proposed northbound off-slip and Boongate Dualling.

4.9.2 The land uses within the area predominantly comprises of residential housing, social infrastructure, highways, on/off-street car parking and recreational land.

4.9.3 The area surrounding the proposed northbound off-slip also provides significant urban green space.

Operational Impacts

4.9.4 Boongate Dualling is likely to benefit the local community with potential pedestrian and cyclist infrastructure being delivered along Bishop's Road and St John's Street. Although this may be possible with the new northbound off-slip, the volume of traffic on Bishop's Road and St John's Street may deter trips by sustainable travel modes. The potential reduction in congestion along Bishop's Road would also benefit the local community and reduce severance between the residential areas and the Embankment.

4.9.5 The proposed northbound off-slip will result in a loss in green space which is used by the community, i.e., specifically the area close to the proposed northbound off-slip which is currently used as a recreational ground.

Construction Impacts

4.9.6 During construction, both of the proposed options are likely to result in an increase in construction jobs which is likely to benefit the local economy. However, disturbance because of construction related activities and machinery may temporarily affect receptors within the vicinity of the schemes including residential properties, places of worship and schools. There is also the potential for community land to be temporarily affected, and the construction of the northbound off-slip would impact the adjacent urban green space which is used for recreational activities.

RAG Rating

4.9.7 A green rating has been attributed to Socio-economic and community impacts for Boongate Dualling. During the construction phase a Slight Adverse effect is anticipated as a result of disturbances for the local community. Long term effects may vary, but on balance they are likely to benefit the community. However, the location of the proposed northbound off-slip adjacent to the recreational urban green land is a potential higher risk to the delivery of this option.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Socio-Economic and Community Impacts		

4.10 Soils and Geology

4.10.1 No Geological SSSI or Regionally Important Geological or Geomorphical (RGIS) have been identified within 1km of either of the proposed options.

4.10.2 The proposed northbound off-slip is located within <50m of a Historic Inert Landfill site. The site comprises two separate parcels of land within the wider site which formerly contained the Potters Way sewage treatment works.

4.10.3 No historic or authorised landfills have been identified within the extent of Boongate Dualling.

4.10.4 Agricultural Land Classification (ALC) surveys would likely indicate that the land around the proposed sites is mostly Grade 4 (poor) urban.

Operational Impacts

4.10.5 Contaminants are unlikely to become permanently mobilised as a result of the either option, with soils likely to be regraded (where possible) to their previous quality.

4.10.6 The proposed northbound off-slip will result in the permanent loss of recreational urban green land if taken forward.

Construction Impacts

4.10.7 Excavations would be required for both of the proposed options, although it is not known to what depth this is required.

4.10.8 There is potential for contaminated land to be present within either of the site extents, and as a result, it will be necessary to consult with Peterborough City Council's Contaminated Land Specialist to determine appropriate soil sampling requirements for the options. A full Ground Investigation would be prepared in advance of works, and where necessary, an appropriate remediation strategy put in place.

RAG Rating

4.10.9 A green rating has been attributed to Soils and Geology. Overall, there is potential for a 'Slight Adverse' impact during construction, with the potential disturbance of contaminated land. However, with appropriate mitigation put in place adverse effects are likely to be reduced to an acceptable level.

4.10.10 At this stage in the assessment of the two options, it is not considered likely that there would be a substantial difference in the likely impacts upon geology and soils. There both the northbound off-slip and Boongate Dualling are rated as green.

Assessment Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Soils and Geology		

4.11 Summary of Environmental Assessment

4.11.1 Table 4.2 below shows the summary of the RAG status for each of the environmental areas for both the northbound off-slip and Boongate Dualling.

Table 4.2: Summary of Environmental Assessment

Environmental Area	Northbound Off-slip (Package 1)	Boongate Dualling (Package 2)
Air Quality		
Archaeology and Cultural Heritage		
Landscape and Visual		
Biodiversity		
Noise and Vibration		
Water: Hydrology and Drainage		
Socio Economic and Community Impacts		
Soils & Geology		
Summary	• The northbound off-slip is situated upon recreational urban green land and should be noted as a potential higher risk to the delivery of the scheme. • It has potential to impact the setting of high value heritage asset Peterborough Cathedral. • Well-established Corsican Elm trees which have a high community asset value situated adjacent to the proposed off-slip and will be affected.	• Boongate provides a favourable habitat for protected species comprising trees, tall ruderals, wildflowers, and scrub.

4.11.2 The overall environmental assessment of the northbound off-slip is Amber and for Boongate Dualling is Amber/Green. This is based on the assumption that appropriate mitigation would be included as part of the scheme design and construction methodology and would be fully developed as the either scheme progresses.

4.11.3 Mitigation may take the form of a CEMP to be implemented by the Contractor during construction, and a fully integrated landscape and ecological design, which would minimise long-term adverse effects upon nature conservation and the local landscape and would provide opportunities for biodiversity enhancements. However, residual risks remain that require further investigation/ environmental assessment, to fully determine the likely scope and scale of mitigation requirement, such as the potential requirement for acoustic attenuation or landscaping.

4.11.4 Protected species surveys may also be required, which would inform the potential requirement for works to be progressed under a licence to be granted by Natural England (where protected species are present), with appropriate mitigation and monitoring in place.

4.11.5 It should be noted that this preliminary assessment has identified that there are a number of additional constraints for the northbound off-slip when compared to Boongate Dualling and which present a greater risk to the delivery. The proposed northbound off-slip is also partially located on recreational ground/urban green space. As a result, the environmental risk for this site is considered to be Amber.

4.11.6 Each of the proposed options exceed the threshold of 1 hectares of development. As a result, both options are considered as Schedule 2 development under the EIA Regulations and will require Screening for Statutory EIA. The Screening Opinion will be made by the Local Planning Authority (LPA) and will be determined according to the likelihood of the proposals to result in significant adverse effects upon the environment. Where statutory EIA is required, this would be prepared in the form of an Environmental Statement (ES), to be submitted to the LPA in support of any Planning Application. Where statutory EIA is not required, stand-alone environmental assessments may still be required to accompany any Planning Application.

5. Operational Assessment

5.1 Introduction

5.1.1 This chapter sets out the operational modelling undertaken for Package 1 and 2. The purpose of the assessment is to compare the operational performance and impact of each package on the highway network in the study area.

5.2 Modelling Approach

5.2.1 A bespoke Aimsun Next (version 20) microsimulation model was built for the purpose of assessing the two packages in detail.

5.2.2 Aimsun Next is based on car following and lane change theory which allows for the anaylysis of motorised traffic operations under conditions such as:

- Lane configuration
- Traffic composition
- Traffic controls such as fixed or actuated traffic signals and give ways
- Public transport stops

5.2.3 The Aimsun Next traffic model has been constructed to represent the morning (AM) peak hour from 08:00 to 09:00, and an evening (PM) peak hour from 17:00 to 18:00, in order to represent the most congested time periods. These peak periods were defined from the traffic surveys undertaken across the study area in September 2019, and follow the standard peak times experienced across Peterborough. A 15 minute warm-up period has been added before each model peak to populate the model network with vehicles and create representative peak period traffic conditions for undertaking peak hour analysis.

5.3 Model Development

5.3.1 A 2019 base model was built using traffic flows and distributions taken from the Peterborough Transportation Model 3 (PTM3) Strategic Saturn Model. PTM3 was used to identify the impacts of the two Packages at a strategic level as reported in the SOBC.

5.3.2 The model was validated and calibrated, using traffic counts and journey times, to ensure it represented the traffic conditions experienced by drivers on this part of the network.

5.3.3 To understand traffic conditions in future years, forecast year matrices from the PTM3 model were used to adjust the base year traffic matrices for the 2026 forecast year. Once growth was applied, a Do Minimum (DM) scenario was created.

5.3.4 Growth beyond 2026 has not been reported for the operational modelling. It was found that growth beyond 2026 exceeded the network capabilities operationally within microsimulation. Future strategies, such as the City Centre Transport Vision, will likely introduce transport interventions beyond 2026 that better manage the demand entering the study area and limit the impact of planned developments on the highway network.

5.3.5 Package 1 and Package 2 improvements were created in the model to create a Do-Something scenario. The operational modelling identified delay occuring at Junction 39 in both Packages, so a scheme to signlaise the junction was developed and forms part of both Package 1 and Package 2.

5.3.6 Each Package was tested to understand its impact on the operational performance on the network.

5.3.7 Package 1 includes the following schemes within the operational model:

- New northbound off-slip linking the A1139 Frank Perkins Parkway with Bishop's Road (Junction 4a)
- Junction 38 – 40m flare extension on Bishop's Road East
- Junction 5 – signalisation of the A1139 Frank Perkins Parkway southbound off-slip
- Boongate / Fengate Junction – 40m flare extension on Fengate West and creation of a dedicated right turn lane on Fengate East
- St John's Street / Wellington Street – creation of a roundabout.

Package 2

5.3.8 Package 2 includes the following schemes:

- Dualling of Boongate between Junction 5 and Junction 39
- Junction 38 – 40m flare extension on Bishop's Road East
- Junction 5 – signalisation of the A1139 Frank Perkins Parkway northbound and southbound off-slip
- Boongate / Fengate Junction – 40m flare extension on Fengate West and creation of a dedicated right turn lane on Fengate East
- St John's Street / Wellington Street – creation of a roundabout.

5.4 Model Results

5.4.1 Performance of the two packages has been assessed on sub-path performance and then for Level of Service (LOS) of the junctions within the study area. The model results are discussed in turn below.

5.5 Sub-Path Performance

5.5.1 Three sub-paths were selected for key routes in the study area to understand the impact of Package 1 and Package 2 in terms of flow, delay and travel time.

5.5.2 The routes selected were:

- Boongate (between Junction 5 and Junction 39)
- Vineyard Road (between Junction 39 and Junction 38)
- Bishop's Road / Fengate (between Junction 38 and Boongate / Fengate junction).

5.5.3 These three routes were chosen as they are the key routes between the A1139 Frank Perkins Parkway in either Package 1 or Package 2.

5.5.4 It is important to note that the figures presented in the tables represent vehicles that complete a jouney along the whole route (or sub-path). Any vehicles leaving or entering the route are not accounted for.

AM Peak Hour

5.5.5 Table 5.1 shows the Sub-path results for the AM Peak Hour.

Table 5.1: Sub-Path Results: AM Peak Hour

Road	Direction	Flow (vehicles)				Delay (seconds)				Travel Time (seconds)			
		Base	DM	P1	P2	Base	DM	P1	P2	Base	DM	P1	P2
Boongate	Eastbound	1,175	1,123	738	1,068	24	16	13	59	61	53	50	59
	Westbound	1,434	1,044	861	1,509	47	222	126	29	91	266	170	73
Vineyard Road	Northbound	785	848	865	789	29	20	118	39	68	60	158	79
	Southbound	607	589	384	647	31	138	610	94	71	178	650	135
Bishop's Road	Eastbound	97	105	113	107	47	56	75	51	157	166	185	160
	Westbound	227	249	265	255	53	108	219	110	173	228	340	231

Base to Do Minimum

5.5.6 It is normally expected for flow to increase between the Base and Do Minimum scenarios, due to growth. However, Boongate and Vineyard Road southbound both decrease in flow, supposedly resulting in a decrease in delay. The model indicates that these trips are no longer able to reach Boongate and Vineyard Road due to increased delay at either end of these links, such as at Junction 39, Junction 38 and Junction 5.

Package 1

5.5.7 In Package 1, the desire lineThe route for vehicles wishing to access Wellington Street Car Park in Package 1 is via the new northbound off-slip, Bishop's Road (westbound) and Vineyard Road / St John's Street (northbound).

5.5.8 Both the delay and travel time on Bishop's Road / Fengate (westbound) increase by approximately 111 seconds. On Bishop's Road / Fengate (eastbound), the increase in delay and travel time is approximately 18 seconds. This increased demand from vehicles on these routes as a result of vehicles using the new northbound off-slip to access the City Centre and Fengate Industrial Area rather the Junction 5.

5.5.9 Examination of the model shows significant queuing on Bishop's Road and the new northbound slip in the AM Peak Hour, as shown in the screen shot in Figure 5.1.

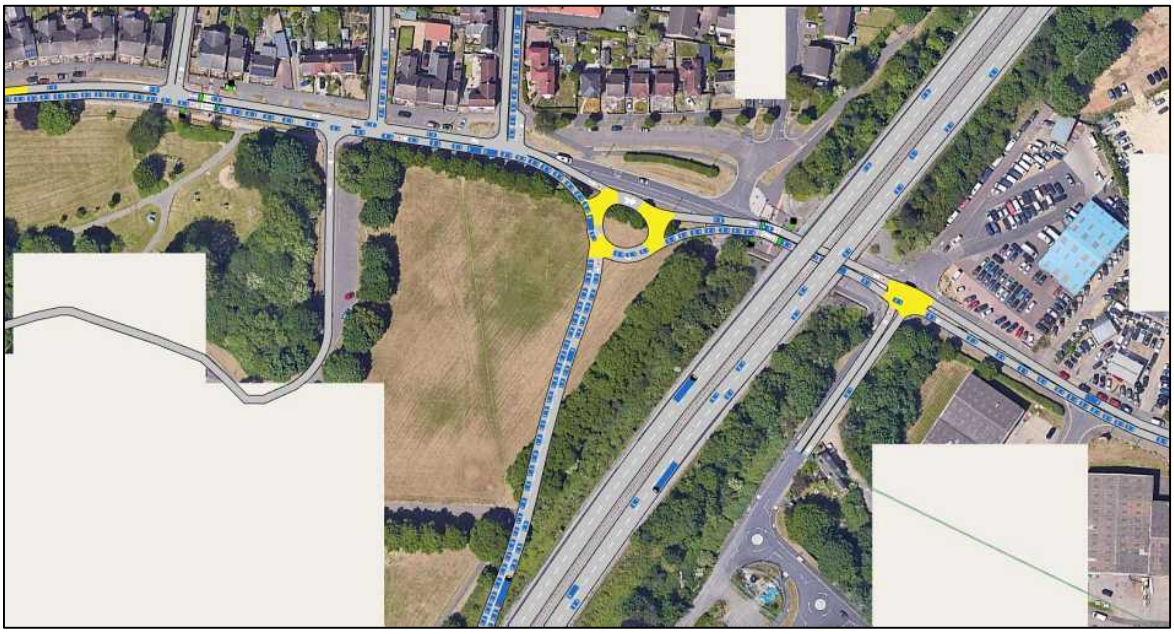

Figure 5.1: AIMSUN Next Screenshot of New Northbound Off-Slip (AM Peak Hour - 8:30am)

5.5.10 Figure 5.1 shows that the provision of a new off-slip causes gridlock on the surrounding local highway network. Significant queuing is experienced on the new northbound off-slip due to the difficulty vehicles have exiting the slip road on to Bishop's Road or Fengate. The queuing extends back on to the A1139 Frank Perkins Parkway, which could negatively impact the performance of the Parkway Network in this location.

5.5.11 In addition, significant queuing can be seen on Fengate for vehicles travelling westbound towards the new roundabout, as well as on Bishop's Road westbound towards Junction 38.

5.5.12 Further improvements to Junction 38 may be possible to reduce queuing and delay. However, Bishop's Road is a low-capacity road, with residential properties to the north. There are no options to improve Bishop's Road to increase the capacity without significantly changing the nature of the road, and the road is very heavily constrained on both sides as it enters Fengate. In addition, any scheme to improve the capacity of Bishop's Road could reduce the land available for development on the Embankment.

5.5.13 Vineyard Road / St John's Street (northbound) also experiences an increase in delay and travel time. In Package 1, the delay is 117 seconds, which is approximately 6 times longer than the delay experiened in the DM Scenario. Travel time along the route is also approximately three times longer at 157 seconds. This is likely because many of the trips destined to Wellington Street Car Park are now coming from the new slip road, resulting in them waiting to make a right turn into Wellington Street (Or continuing up to Junction 39) causing greater delay on this link.

5.5.14 Figure 5.2 shows a model screenshot of the study area approximately halfway through the AM Peak Hour.

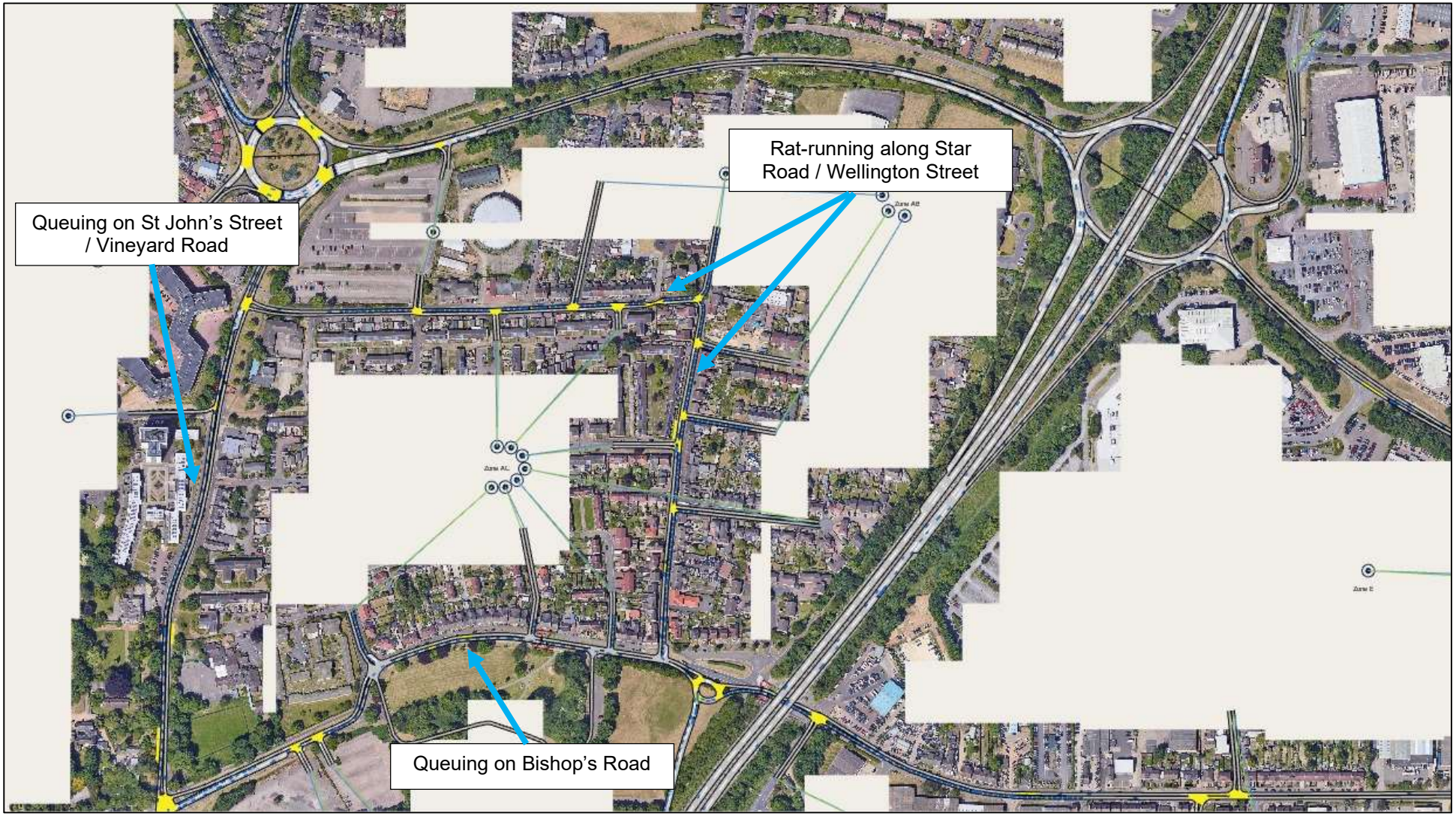

Figure 5.2: AIMSUN Next Screenshot of Vineyard Road (AM Peak Hour - 8:30am)

5.5.15 The screenshot shows significant queuing along Vineyard Road / St John's Street. Similar to Bishop's Road, it is a low-capacity link and there are very few options to singificantly increase the capacity of this route.

5.5.16 Figure 5.2 also shows significant queues on Star Road. This is likely to be vehicles re-routing along Star Road in both directions to avoid delay on Bishop's Road, Vineyard Road and at Junction 38. Star Road is a residential route with traffic-calming to deter re-routing vehicles. Increasing the number of vehicles along this route would not be acceptable.

5.5.17 Package 1 reduces flow, delay and travel time on Boongate in both directions. This is a result of traffic using the new northbound off-slip to access the City Centre rather than Junction 5.

Package 2

5.5.18 In Package 2, vehicles will travel via Junction 5 and Boongate (westbound) to access the parking at Wellington. Table 5.1 shows a increase in demand on Boongate (westbound) of nearly 500 vehicles in the AM Peak Hour. Although there is a significant increase in flow, there is only a small increase in travel time (6 seconds). The delay along the route increases by approximately 40 seconds, however this is likely to be due to the introduction of traffic signals at Junction 39.

5.5.19 Boongate Dualling will provide a high capacity link direct from the A1139 Frank Perkins Parkway to the Wellington Street Car Park. Despite the significant increase in flows, the impact on delay and travel time is small, therefore the proposed improvements accomodate the additional traffic and Boongate operates efficiently.

5.5.20 Package 2 reduces delay and travel time on Vineyard Road / St John's Street and Bishop's Road / Fengate in both directions. Figure 5.3 shows a screenshot of the study area in the AM Peak Hour.

Figure 5.3: AIMSUN Next Screenshot of Study Area with Package 2 (AM Peak Hour - 8:30am)

5.5.21 Figure 5.3 shows very little queuing and delay on the network during the AM Peak Hour, and no re-routing on Star Road.

PM Peak Hour

5.5.22 Table 5.2 shows the Sub-path results for the PM Peak Hour.

Table 5.2: Sub-Path Results - PM Peak Hour

Road	Direction	Flow (vehicles)				Delay (seconds)				Travel Time (seconds)			
		Base	DM	P1	P2	Base	DM	P1	P2	Base	DM	P1	P2
Boongate	Eastbound	1,586	1,495	1,140	1,344	71	26	14	18	108	63	51	55
	Westbound	887	876	343	1,021	10	30	128	18	54	75	172	61
Vineyard Road	Northbound	715	755	861	715	20	36	51	27	59	76	90	66
	Southbound	539	467	235	539	51	262	693	134	92	302	733	176
Bishop's Road	Eastbound	109	113	105	118	44	68	93	60	154	177	202	170
	Westbound	220	254	308	297	41	78	117	78	160	198	237	198

Base to Do Minimum

5.5.23 It is normally expected for flow to increase between the Base and Do Minimum scenarios, due to growth. However similar to the AM Peak, Boongate and Vineyard Road southbound both decrease in flow. Significant increases in delay are also observed with Vineyard Road southbound increasing from 51 seconds of delay to 262 seconds. Boongate Eastbound is the only link that experiences a decrease in delay between the Base and Do Minimum, although this is due to the decreased flow stemming from delays at Junction 39.

Package 1

5.5.24 In the PM Peak, vehicles are likely to be exiting the City Centre area towards the Parkway Network. The new northbound off-slip does not accomodate these trips, therefore vehicles will use existing routes; Vineyard Road and Boongate.

5.5.25 Package 1 increases the delay and travel time on all routes except Boongate (eastbound). This suggests the network is not performing as efficiently as it could even with improvements, particularly on those routes which see a decrease in flow.

5.5.26 Boongate (eastbound) has a reduction in vehicle flow of approximately 350 vehicles, this is likely to be a result of the Junction 39 signals slowing the rate at which trips bound to Boongate can get there. Whilst this seems to be a disbenefit, other movements around the junction are likely to be benefitting greatly from this improvement. In addition, Boongate / Fengate junction is operating more effectively therefore vehicles may choose this route instead of Boongate to reach Junction 5 and the Parkway Network to avoid delay on Vineyard Road / St John's Street.

5.5.27 Figure 5.4 shows a screenshot of the study area for Package 1 in the PM Peak Hour.

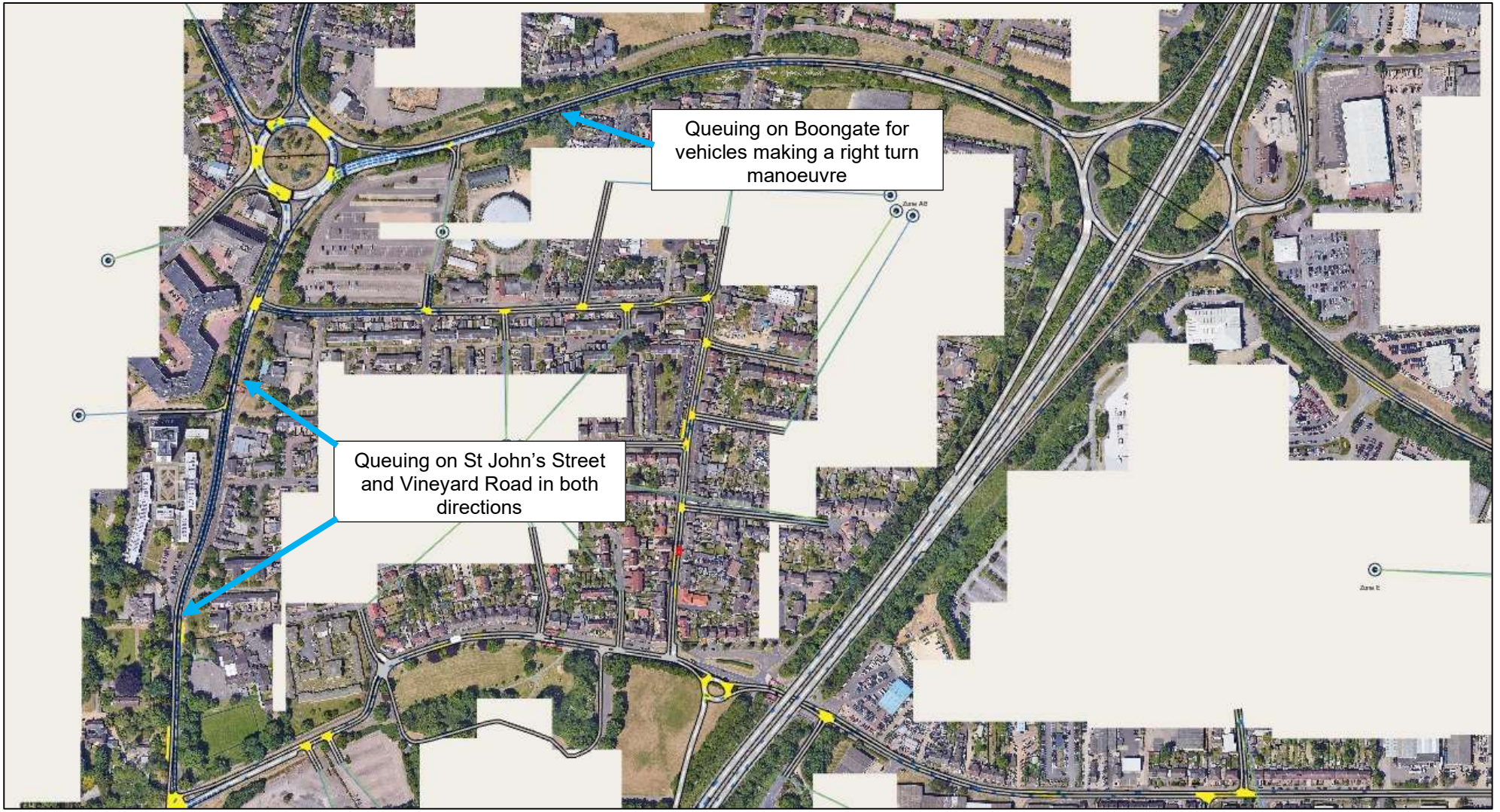

Figure 5.4: AIMSUN Next Screenshot of Study Area with Package 1 (PM Peak Hour)

5.5.28 Figure 5.4 shows signficant queuing and delay on Vineyard Road / St John's Street.There is also queues on the approaches to Junction 39, particularly for vehicles wishing to make a right turn manouvre.

Package 2

5.5.29 In the PM Peak Hour, Package 2 decreases delay and travel time on all but one of the routes presented in Table 5.2. Boongate (westbound) sees a negligible increase in delay and travel time of less than 1 second. This suggests the network is operating efficiently.

5.5.30 Figure 5.5 shows a screenshot of the study area for Package 2 in the PM Peak Hour.

Figure 5.5: AIMSUN Next Screenshot of Study Area with Package 2 (PM Peak Hour)

5.5.31 Figure 5.5 shows the network across the study area working efficiently with minimal queuing and delay. There is some queuing on the Boongate (eastbound) approach to Junction 5 for vehicles wishing to make a right-turn manoeuvre. A two-lane exit on the A1139 Frank Perkins Parkway southbound on-slip will be investigated at the next stage to see if this delay can be minimised.

5.6 Overall Junction Performance

5.6.1 Junction performance has been assessed using the Level of Service Indicator (LOS)

5.6.2 The LOS indicator has also been included in order to provide a reference to junction performance. The LOS is a concept derived from the American Highway Capacity Manual (2000). It rates performance based upon queue delay thresholds on an 'A' to 'F' grading as follows:

- LOS A – 0 to 10 seconds
- LOS B – 10 to 20 seconds (10 to 15 seconds for unsignalised junctions)
- LOS C – 20 to 35 seconds (15 to 25 seconds for unsignalised junctions)
- LOS D – 35 to 55 seconds (25 to 35 seconds for unsignalised junctions)
- LOS E – 55 to 80 seconds (35 to 50 seconds for unsignalised junctions)
- LOS F – Over 80 seconds (over 50 seconds for unsignalised junctions)

5.6.3 The LOS for a junction is based on the average of the queue delay on the approaches, weighted by the flow of each apporach, according to the same ranges as above.

5.6.4 A LOS of E is considered to be at capacity, whilsy an LOS of F is considered to be over capacity.

AM Peak Hour

5.6.5 Table 5.1 details the overall LOS for each junction within the study area for the AM Peak Hour. The cell is highlighted in green where the LOS is maintained or improved compared to the Do Minimum Scenario. Green indicates an improvement in performance over the DM (or an LOS remains the same), and junctions that perform worse than the DM have been highlighted in red.

Table 5.1: Level of Service for Junctions in Study Area – AM Peak Hour

Junction	Level of Service		
	DM	P1	P2
Junction 37	B	B	A
Junction 38	E	F	D
St John's Street / Wellington Street	A	A	A
Junction 39	C	D	C
Junction 5	C	B	B
Boongate / Fengate	C	D	C

5.6.6 Package 1 improves or maintains the overall LOS for three junctions within the study area in the AM Peak Hour. However, the Package does not improve the performance of Junction 38, which maintains a LOS rating of F, and is operating over-capacity.

5.6.7 Package 2 improves or maintains the overall LOS for all the junctions within the study area. All of the junctions perform with a LOS of D or above.

PM Peak

5.6.8 Table 5.2 details the overall LOS for each junction within the study area in the PM Peak Hour. The cell is highlighted in green where the LOS is maintained or improved compared to the Do Minimum Scenario. Green indicates an improvement in performance over the DM (or an LOS that remains the same), and junctions that perform worse than the DM have been highlighted in red.

Table 5.2: Level of Service for Junctions in Study Area – PM Peak Hour

Junction	Level of Service		
	DM	P1	P2
Junction 37	B	B	A
Junction 38	F	F*	E
St John's Street / Wellington Street	A	C	A
Junction 39	E	D	C
Junction 5	D	B	C
Boongate / Fengate	C	D	C

**Note that despite being LOS in both scenarios, the level of delay increases at this junction in Package 1.*

5.6.9 In the PM Peak Hour, Package 1 improves or maintains the LOS at four junctions across the study area. However, Junction 38, maintains a LOS rating of F, which is considered to be over capacity.

5.6.10 Package 2 improves or maintains the LOS at all the junctions across the study area. However, the improvement at Junction 38 is only marginal with an LOS of E compared to F in the DM Scenario.

5.6.11 To further understand the impact of each of the Packages at the junctions in the study area, assessment of the approaches to each junction has been undertaken. The assessment considers flow, mean queue length, queue delay and LOS for each approach.

5.7 Junction Performance by Approach

AM Peak Hour

5.7.1 Table 5.3 shows the performance for each junction by approach for the AM Peak Hour for both Package 1 and Package 2. The cell is highlighted in green where the LOS is maintained or improved compared to the Do Minimum Scenario. It is highlighted in red where the LOS is worse that the Do Minimum and is operating at or over-capacity (LOS of E or F).

Table 5.3: Level of Service for Appraoches to Junctions in Study Area – AM Peak Hour

Junction	Approach	Flow			Mean Queue Length (m)			Queue Delay (secs per veh)			Level of Service (LOS)		
		DM	P1	P2	DM	P1	P2	DM	P1	P2	DM	P1	P2
Junction 37	A15 Bourges Boulevard	256	255	264	3	3	3	15	15	13	B	C	B
	Bishop's Road	262	211	271	2	2	2	11	12	11	B	B	B
	A15 London Road	364	357	372	1	2	2	6	5	6	A	A	A
Junction 38	Vineyard Road	187	118	194	15	28	12	80	354	62	F	F	F
	Bishop's Road (E)	121	192	128	10	11	5	58	79	46	F	F	E
	Bishop's Road (W)	263	256	275	2	3	1	10	16	2	B	C	A
St John's Street / Wellington Street	St John's Street (N)	240	134	216	0	0	0	0	0	0	A	A	A
	Wellington Street	76	69	70	2	3	3	21	51	44	C	F	E
	St John's Street (S)	228	250	249	0	0	0	0	0	0	A	A	A
Junction 39	Eastfield Road	127	61	102	3	12	9	44	102	73	E	F	F
	Boongate	265	218	386	2	4	3	14	22	13	B	C	B
	St John's Street	262	278	246	1	4	3	7	21	16	A	C	B
	New Road	39	39	39	0	0	0	10	5	8	B	A	A
	Crawthorne Road	219	144	212	11	10	6	41	58	30	E	E	C
Junction 5	A1139 Southbound Off-slip	236	236	236	5	3	4	29	22	23	D	C	C
	Carr Road	67	76	75	2	0	2	86	7	25	F	A	C
	Boongate (E)	97	109	105	1	1	1	18	13	11	C	B	B
	A1139 Northbound Off-slip	292	306	505	3	1	2	8	5	5	A	A	A
	Boongate (W)	280	195	269	3	1	3	10	8	14	B	A	B
Boongate / Fengate	Boongate	86	75	101	1	1	2	21	26	25	C	C	C
	Fengate (E)	127	130	129	1	2	2	15	19	19	B	B	B
	Fengate (W)	101	131	103	2	3	2	35	32	25	D	C	C

Package 1

5.7.2 Package 1 improves or maintains the LOS rating at sixteen of the junction approaches in the AM Peak Hour. It decreases the LOS rating at six of the approaches.

5.7.3 Package 1 does not improve the performance of the approaches to Junction 38. Vineyard Road and Bishop's Road (East) maintain an LOS of F, whilst Bishop's Road (West) decreases to a LOS rating of C from a B in the DM scenario. This suggests the increased demand on Bishop's Road (East) approach may be reducing the available gaps for traffic on Bishop's Road (West).

5.7.4 The new northbound off-slip from A1139 Frank Perkins Parkway to Bishop's Road significantly increases the flow on the Bishop's Road (East) approach (71 vehicles). Vehicles are now using this junction to access to City Centre rather than Junction 5. The Vineyard Road approach to the junction, has less vehicle demand on its approach as a result of Package 1, but sees a significant increase in Queue Delay (354 seconds per vehicle compared to 80 seconds per vehicle in the DM scenario).

5.7.5 Package 1 has a positive impact on all approaches to Junction 5. The LOS is improved in four out of five approaches. This is to be expected as vehicles travelling northbound on the A1139 Frank Perkins Parkway wishing to access the City Centre have the option to use the new northbound off-slip. Carr Road sees a significant reduction in queue delay, decreasing from 86 seconds per vehicle in the DM scenario to 7 seconds in Package 1. This is likely to be a consequence of the introduction of traffic signals on the A1139 Frank Perkins Parkway southbound off-slip, providing more opportunity to enter the circulatory from Carr Road. All other approaches experience a reduction in the queue delay of between 2 and 7 seconds per vehicle.

5.7.6 The performance of some approaches to Junction 39 decline with the implementation of Package 1. The LOS rating of Boongate and St John's Street decreases to a C which still suggests these approaches are still operating effectively. Eastfield Road approach to the junction has an LOS rating of F (compared to a E in the DM Scenario), this may be a result of traffic signals being implemented at the junction.

5.7.7 The St John's Street / Wellington Street Junction experiences a decrease in LOS from C to F on the Wellington Street approach. This is a result of the increased traffic on Wellington Street exiting the Car Park and also higher vehicle flows travelling northbound on St John's Street reducing the available gaps for traffic to turn out of Wellington Street.

5.7.8 The Boongate / Fengate junction maintains its LOS on both the Boongate and Fengate (East) approaches. However, Fengate (West) sees an improvement to its LOS rating from a D to a C. The Fengate (West) arm experiences an increase in vehicle flow of 30 vehicles in Package 1 compared to the DM scenario.

5.7.9 This is due to an increased number of vehicles using the new northbound off-slip to access to Fengate area or the improved efficiency of Junction 5 resulting in vehicles using this route to access the Parkway Network. The impact on Mean Queue Length and Queue Delay at the junction is marginal suggesting that the proposed improvement enables the junction to operate efficiently.

Package 2

5.7.10 In the AM Peak hour, Package 2 improves or maintains the LOS rating all but three of the approaches to junctions across the study area.

5.7.11 As a result of the change in car parking assumptions, with the Embankment Area car parking to be located at Wellington Street, the key routes in Package 2 are Junction 5, Boongate and Junction 39.

5.7.12 Package 2 significantly increases the flow on the A1139 Frank Perkins Parkway northbound off-slip, from 202 vehicles in the DM Scenario to 505 vehicles. Package 2 improves or maintains the LOS for all approaches to Junction 5, and despite increases in vehicle flow on three out of five approaches, there is a negligible change in both the mean queue length and queue delay. This suggests that the proposed signalisation of both the northbound and southbound off-slips enables the junction to process more vehicles more effectively.

5.7.13 Junction 39 experiences an increase of 121 vehicles on the Boongate approach in the AM Peak Hour, although this has little impact on the mean queue length and queue delay of this approach. This suggests the proposed improvements at Junction 39 are improving the operational efficiency of the junction. More traffic is able to pass through the junction and the junction is operating more efficiently. The Eastfield Road approach to the junction has an LOS rating of F (compared to a E in the DM Scenario), this may be a result of traffic signals being implemented at the junction and competing flows on other approaches.

5.7.14 The St John's Street / Wellington Street junction experiences a decrease in LOS rating on the Wellington Street approach. In the DM scenario, the LOS is C, in Package 2 it is rated as a E, which suggests it is operating at capacity. This worsening performance is also supported by the queue delay increasing by 23 seconds per vehicle on the Wellington Street approach. This is likely to be due to the increased demand on Wellington Street from vehicles exiting the car park and increasing difficulty for vehicles to exit the junction due to flows on St John's Steet increasing.

5.7.15 Package 2 results in a small increase in flow at Junction 38. However, the queue delay on all approaches reduces. The biggest reduction is seen on the Vineyard Road approach with an 18 seconds per vehicle reduction, however the LOS is maintained at an F suggesting this junction is still struggling with the demand even with the proposed improvement.

5.7.16 The Boongate /Fengate junction experiences an increase on flow on all junctions, especially on Boongate, with an increase of 15 vehicles in the AM Peak Hour. This is likely to be as a result of an improved Junction 5 being a more attractive route in to Fengate. The LOS at the junction is maintained on all approaches.

PM Peak

5.7.17 Table 5.4 shows the performance on each junction by approach for the PM Peak Hour for both Package 1 and Package 2.

5.7.18 The cell is highlighted in green where the LOS is maintained or improved compared to the DM, and red where there has been a reduction in the LOS. Where both the DM and DS scenarios have a LOS F, the cell has been coloured on the level of delay (number of seconds) with green showing an improvement and red showing a reduction in performance.

Table 5.4: Level of Service for Approaches to Junctions in Study Area – PM Peak Hour

Junction	Approach	Flow			Mean Queue Length (m)			Queue Delay (secs /veh)			Level of Service (LOS)		
		DM	P1	P2	DM	P1	P2	DM	P1	P2	DM	P1	P2
Junction 37	A15 Bourges Boulevard	293	273	300	3	3	2	15	16	12	C	C	B
	Bishop's Road	260	208	276	2	2	2	13	12	14	B	B	B
	A15 London Road	352	337	352	2	2	1	6	6	5	A	A	A
Junction 38	Vineyard Road	155	72	167	21	32	17	167	424	124	F	F	F
	Bishop's Road (E)	122	203	133	4	8	4	46	62	44	E	F	E
	Bishop's Road (W)	257	231	255	2	4	1	14	23	4	B	C	A
St John's Street / Wellington Street	St John's Street (N)	156	76	156	0	0	0	0	0	0	A	A	A
	Wellington Street	74	94	76	1	9	1	15	106	15	B	F	B
	St John's Street (S)	215	265	230	0	0	0	0	0	0	A	A	A
Junction 39	Eastfield Road	117	45	117	13	173	12	115	96	117	F	F	F
	Boongate	320	135	349	2	25	2	7	28	11	A	C	B
	St John's Street	254	316	242	2	51	2	13	14	10	B	B	B
	New Road	58	58	59	2	28	1	53	14	28	F	B	D
	Crawthorne Road	128	96	130	10	121	1	101	38	19	F	D	B
Junction 5	A1139 Southbound Off-slip	98	99	98	1	1	1	10	16	17	A	B	B
	Carr Road	71	131	125	17	1	4	211	15	43	F	C	E
	Boongate (E)	91	99	92	2	2	2	31	41	37	D	E	E
	A1139 Northbound Off-slip	252	116	254	0	0	1	2	2	8	A	A	A
	Boongate (W)	374	285	362	3	1	7	16	9	22	C	A	C
Boongate / Fengate	Boongate	98	64	96	1	1	0	19	26	25	B	C	C
	Fengate (E)	99	123	123	2	2	1	23	21	21	C	C	C
	Fengate (W)	126	149	128	4	5	0	37	43	33	D	D	C

Package 1

5.7.19 Package 1 improves or maintains the LOS rating at thirteen of the junction approaches in the PM Peak Hour. It decreases the LOS rating at nine of the approaches.

5.7.20 Junction 38 is operating over-capacity in the PM Peak Hour, with two of its approaches having a LOS rating of F. Bishop's Road (East) experiences a significant increase in vehicle flow with 81 additional vehicles. This is increase is probably due to an increased demand from vehicles using the northbound off-slip to access the City Centre. Vineyard Road experiences significant delays with a queue delay of 424 seconds per vehicle compared to 127 seconds per vehicle in the DM Scenario.

5.7.21 Package 1 increases the flow on Wellington Street by 20 vehicles and St John's Street (South) by 50 vehicles. This has a corresponding impact on the queue delay on Wellington Street, with a delay of 106 seconds per vehicle compared to 15 seconds per vehicle in the DM Scenario. Wellington Street has a LOS of F indicating the approach is operating over-capacity. The delay is likely to be caused by an increased demand on Wellington Street from vehicles exiting the car park and higher flows on the St John's Street (South) approach resulting in limited opportunities for vehicles to exit Wellington Street.

5.7.22 Package 1 improves or maintains the LOS on all approaches to Junction 39 except Boongate, where the LOS rating reduces from an A to a C. However, Eastfield Road maintains its LOS of F with an increase in mean queue length of 160m. The Crawthorne Road approach experiences significant increases in mean queue length (111m), however queue delay is less than the DM Scenario. This suggests that the implementation of traffic signals might be causing longer queues, but it is clearing them more effectively.

5.7.23 The introduction of traffic signals on the Junction 5 southbound off-slip significantly improves the queue delay on Carr Road. In the DM Scenario the queue delay is 211 seconds, decreasing to 15 seconds in Package 1. This is likely to be the result of increased opportunities to enter the circulatory afforded by the traffic signals.

5.7.24 As a result of the reduced delay on the Carr Road approach, the vehicle flow is increased from 71 vehicles in the DM Scenario to 131 vehicles. Boongate (East) has a reduced LOS rating of E compared to D in the Package 1 scenario suggesting it is operating at-capacity. This could be due to the increased vehicle demand from Carr Road, reducing opportunities for vehicles from Boongate (East) to enter the circulatory.

5.7.25 The Boongate / Fengate junction experiences an increase in flow on both Fengate (West) and Fengate (East) approaches with approximately a 20 vehicle increase on each approach. However, all approaches have an LOS of D or above indicating the junction is operating efficiently.

Package 2

5.7.26 Package 2 improves or maintains the LOS rating at all but four of the approaches to junctions across the study area in the PM Peak Hour.

5.7.27 Package 2 maintains or improves the LOS on the approaches at Junction 38, however it is still operating over-capacity with two approaches having a LOS of E or F. There are marginal increases in traffic flows on the Vineyard Road and Bishop's Road (East) approaches, however the mean queue length and the queue delay are less than the DM Scenario, which suggests the improvement is enhancing the performance of the junction.

5.7.28 The operation of St John's Street / Wellington Street junction is similar to that of the DM Scenario in the PM Peak hour. There are marginal differences in flows, mean queue lengths and queue delay.

5.7.29 The operation of Junction 39 is improved with the implementation of Package 2. Four of the five approaches to the junction improve or maintain their LOS rating. The Boongate approach experiences an increase in vehicle flow compared to the DM Scenario (29 vehicles), however the mean queue length and queue delay have marginal differences which indicates that the proposed improvement is enabling the junction to process more traffic more efficiently. This is further supported by the decrease in queue delay on Crawthorne Road (101 seconds per vehicle to 19 seconds per vehicle) and New Road (53 seconds per vehicle to 28 seconds per vehicles. Eastfield Road maintains its LOS of F.

5.7.30 The introduction of traffic signals on both the northbound and southbound off-slip at Junction 5 significantly improves the operation of the Carr Road approach to the junction. In the DM Scenario the queue delay is 211 seconds, reduced to 43 seconds in Package 2. As discussed previously, the introduction of the traffic signal has provided more opportunities for vehicles on this approach to enter the circulatory. Boongate (East) has a reduced LOS rating of E compared to D in the DM Scenario. This could be due to an increased flow from Carr Road, reducing opportunities for vehicles from Boongate (East) to enter the circulatory.

5.7.31 The LOS on all approaches to the Boongate / Fengate junction are all a C. There is a moderate increase in vehicle flow on Fengate (East) of 24 vehicles however there is a negligible impact on mean queue length and queue delay. This suggests the proposed improvements enable the junction to operate effectively.

5.8 Football Stadium Sensitivity Test

5.8.1 The Council formally entered discussions regarding the relocation of the Peterborough United Football Stadium to the Embankment, from its current sire on London Road, shortly before finalisation of the SOBC.

5.8.2 To date, there has been no confirmation as to whether the stadium will relocate. However, if the relocation of the stadium were to occur, it will significantly impact the highway network across the study area.

5.8.3 The Football Stadium Sensitivity test has been undertaken to demonstrate how each Package performs should the Football Stadium relocate to the Embankment.

Sensitivity Test Assumptions

5.8.4 For the purposes of this sensitivity test, the worst-case scenario is assumed to be a football match event beginning at the end of the PM Peak Hour on a weekday. The following assumptions have been made in the sensitivity test:

- Total number of supporters visiting the Stadium is estimated to be 14,000
- 25% of football supporters (home and away) will travel to each home game by car (based on Coventry's Ricoh Arena Travel Plan)
- 3,500 inbound car trips for an evening weekday game (25% of 14,000).

5.8.5 These assumptions have been taken from, and are consistent with, the Fletton Quays Footbridge Strategic Outline Business Case which was produced in October 2021.

5.8.6 With regards to Car Parking for these additional vehicles, it is assumed that most car parks within the study area will be mostly empty during the PM Peak. Therefore, the following proportions in Table 5.5 have been assumed for each car park for accommodating supporter car trips.

Table 5.5: Car Parking Assumptions for Football Stadium

Car Park	Proportion of Trips	Number of Trips
Pleasure Fair	9%	315
Key Theatre	2%	70
Bishop's Road	6%	210
Wellington Street	42%	1,470
East Station Road	11%	85
Sub Total (Internal Car Park Trips)	**70%**	**2,450**
Unaccounted Trips (External Car Park Trips)	**30%**	**1,050**

5.8.7 The unaccounted trips are assumed to either park on-street or in other car parks outside of the study area. Therefore, an additional 2,450 car trips are estimated to travel into the study area in the PM Peak Hour of a weekday matchday and park inside the study area.

Model Network Statistics Summary

5.8.8 Table 5.6 below shows the Model Summary Statistics for the Football stadium Sensitivity Test. P1+ and P2+ refer to the football stadium sensitivity test.

Table 5.6: Model Network Statistics Summary

Network Statistics	P1	P1+	P2	P2+
Delay Time (s)	73	86	60	70
Flow (vehicles)	12,081	13,056	13,077	14,173
Mean Queue (m)	412	474	237	303
Total Distance Travelled (m)	5,509	5,773	6,091	6,363
Travel Time	127	141	115	126

5.8.9 Table 5.7 indicates that the model network is suffering from suppressed demand under the Football Sensitivity Testing, for both Packages. Despite an increase in trips of 2,450, the traffic flow increases by roughly 1,000 in both scenarios, indicating that many of the new trips are unable to make it into the modelled area. This suppressed demand is therefore not impacting the study area as much is it could be, should improvements be made that allow this traffic into the modelled area.

5.8.10 One example of this is the A1139 Frank Perkins Parkway. It is a known issue that the Parkway will likely be at or near capacity in future years, which directly affects how much traffic will make it to Junction 5. Improvements such as this are outside the scope of this study but may have an effect on this study area later on should they occur.

5.8.11 Table 5.7 shows that for Package 1, the average delay time per vehicle increases by 13 seconds (equivalent to an 18% increase) when the football traffic is applied. For Package 2, this average delay per vehicle increases by 9 seconds (equivalent to a 15% increase). These statistics show that the additional traffic associated with the football stadium has a significant impact on average delay to vehicles across the whole network, although Package 2 copes slightly better than Package 1.

5.8.12 Overall model network statistics indicate that Package 2 can cope slightly better with the additional traffic than Package 1, however the average delay per vehicle is still a significant increase.

5.8.13 As more certainty about the relocation of the Football Stadium comes forward, as well as the design of the preferred package progresses. Further assessments on the impact will be undertaken.

Model Results

5.8.14 Table 5.6 shows the LOS for approaches to all junctions in the PM Peak Hour. P1 and P2 refer to the scenarios discussed previously in this chapter. P1+ and P2+ refer to the football stadium sensitivity test.

5.8.15 Approaches where the LOS is E or F are highlighted red to show where capacity issues on the network are occurring.

Table 5.6: Level of Service for Approaches to Junctions in Study Area – PM Peak Hour (Football Stadium Sensititivity Test)

Junction	Approach	Flow				Mean Queue Length (m)				Queue Delay (secs /veh)				Level of Service (LOS)			
		P1	P1 +	P2	P2+	P1	P1 +	P2	P2+	P1	P1 +	P2	P2+	P1	P1 +	P2	P2+
Junction 37	A15 Bourges Boulevard	293	304	300	342	3	4	2	3	16	18	12	14	C	C	B	B
	Bishop's Road	260	210	276	267	2	2	2	3	12	14	14	17	B	B	B	C
	A15 London Road	352	367	352	379	2	2	1	2	6	6	5	6	A	A	A	A
Junction 38	Vineyard Road	155	80	167	198	32	32	17	14	424	436	124	105	F	F	F	F
	Bishop's Road (E)	122	215	133	124	8	10	4	6	62	67	44	53	F	F	E	F
	Bishop's Road (W)	257	262	255	277	4	3	1	1	23	19	4	4	C	C	A	A
St John's Street / Wellington Street	St John's Street (N)	156	94	156	233	0	0	0	0	0	0	0	0	A	A	A	A
	Wellington Street	74	85	76	55	9	10	1	4	106	121	15	42	F	F	B	E
	St John's Street (S)	215	288	230	240	0	0	0	0	0	0	0	0	A	A	A	A
Junction 39	Eastfield Road	117	37	117	93	173	173	12	14	96	112	117	138	F	F	F	F
	Boongate	320	157	349	371	25	25	2	2	28	27	11	11	C	C	B	B
	St John's Street	254	303	242	204	51	51	2	1	14	13	10	10	B	B	B	B
	New Road	58	59	59	65	28	31	1	1	14	20	28	23	B	C	D	C
	Crawthorne Road	128	68	130	173	121	125	1	5	38	57	19	34	D	E	B	C
Junction 5	A1139 Southbound Off-slip	98	163	98	162	1	1	1	2	16	15	17	17	B	B	B	B
	Carr Road	71	129	125	114	1	1	4	8	15	13	43	61	C	B	E	F
	Boongate (E)	91	108	92	101	2	2	2	3	41	42	37	47	E	E	E	E
	A1139 Northbound Off-slip	252	179	254	349	0	1	1	2	2	4	8	8	A	A	A	A
	Boongate (W)	374	245	362	334	1	1	7	3	9	8	22	16	A	A	C	C
Boongate / Fengate	Boongate	98	68	96	94	1	1	0	0	26	26	25	25	C	C	C	C
	Fengate (E)	99	130	123	136	2	2	1	4	21	21	21	21	C	C	C	C
	Fengate (W)	126	148	128	126	5	5	0	0	43	41	33	31	D	D	C	C

5.8.16 The addition of the Football Stadium may appear to make little impact to the operational performance of the junctions across the study area. However, as much of the demand appears to be suppressed (as suggested by the model summary statistics), these results should be treated with caution.

Package 1

5.8.17 Junction 38 continues to suffer significant delays on the Vineyard Road approach, with a 12 seconds per vehicle increase in queue delay. The LOS of F is maintained on both Vineyard Road and Bishop's Road (East). Bishop's Road (East) has increase 93 vehicles on its approach. This is likely to reflect the increase demand from vehicles using the new off-slip to access the city centre car parks.

5.8.18 The Wellington Street approach to the St John's Street / Wellington Street Junction maintains its LOS of F with queue delay increasing by 15 seconds per vehicle.

5.8.19 Junction 39 continues to operate effectively on the majority of approaches. Eastfield Road maintains its LOS of F and experiences an increase in queue delay of 16 seconds per vehicle even though flow is significantly reduced. Similarly, the LOS for Crawthorne Road decreases from D to E but traffic flow is significantly reduced.

5.8.20 The addition of the football traffic increases the flow on the Junction 5 southbound off-slip by 65 vehicles, however there no corresponding impact to mean max queue and queue delay suggesting the proposed improvements to the junction can accommodate the additional demand. All the other approaches maintain their LOS. Boongate (East) continues to operate at capacity, this is a result of reduced opportunities to enter the circulatory, as discussed previously.

5.8.21 The additional traffic associated with the Football Stadium, increased flow on both Fengate (East) and Fengate (West) approaches to the Boongate / Fengate junction. However, there is minimal impact on mean max queue and queue delay, suggesting the proposed improvements at the junction enable it to operate effectively with the additional demand.

Package 2

5.8.22 The football stadium traffic places additional demand on the Vineyard Road approach and Bishop's Road (West) approach to Junction 38. This is likely to reflect the increase demand from vehicles accessing the city centre car parks. Vineyard Road continues to suffer significant delays, although it is reduced by 19 seconds per vehicle. The LOS of F is maintained on both Vineyard Road and the LOS Bishop's Road (East) decreases from LOS E to LOS F.

5.8.23 The St John's Street / Wellington Street Junction experiences a significant increase in flow on the St John's Road (North) approach (77 vehicles), this is a result of vehicles travelling though the city centre to access car parking. The Wellington Street approach to the junction experiences a decrease in flow, however the LOS decreases from LOS B to LOS E.

5.8.24 Junction 39 continues to operate effectively on the majority of approaches with a LOS of B or C on four out of five approaches. However, Eastfield Road maintains its LOS of F and experiences an increase in queue delay of 21 seconds per vehicle even though flow is significantly slightly.

5.8.25 The Junction 5 northbound off-slip has a 94 vehicle increase in flow, and the southbound off-slip experiences a 64 vehicle increase. This reflects increased demand for vehicles arriving to the city centre. However there no corresponding impact to mean max queue and queue delay on these approaches suggesting the proposed improvements can accommodate the additional demand. Carr Road and Boongate (East) have a LOS of F and E respectively. This is as a result of less opportunities to enter the circulatory due to increased demand from the A1139 Frank Perkins Parkway off-slips.

5.8.26 The approaches to the Boongate / Fengate junction do not experience significant changes to flow, mean max queue or queue delay. This maybe as a result of traffic using Boongate, Junction 39 and Vineyard Road to access City Centre car parks rather than this junction.

5.9 Summary

5.9.1 The Operational Assessment has shown that Package 2 performs better than Package 1 based on the Model Summary Statistics, Subpath analysis and LOS results.

5.9.2 Bishop's Road is a low-capacity road with residential properties along its northern edge. The additional demand on Bishop's Road in Package 1 causes gridlock on the adjacent highway network with vehicles travelling westbound on Bishop's Road and Fengate, and northbound on Vineyard Road experiencing severe delays. The queuing and delay on these routes causes a significant amount of traffic to re-route along Star Road to avoid these delays. Star Road already has traffic calming and any increase in vehicles on this route is likely to be unacceptable. There are limited options to increase the capacity of Bishop's Road or Vineyard Road without significantly changing the nature of the road.

5.9.3 The queuing and delay along Bishop's Road have a knock-on impact to the new northbound off-slip which also suffers from severe queues, extending back to the A1139 Frank Perkins Parkway.

5.9.4 Package 2 provides a high-quality, high-capacity direct route from the A1139 Frank Perkins Parkway to Wellington Street Car Park. Overall Package 2 operates effectively in both the AM and PM Peak Hours. The impact on queuing and delay on the approaches to the junctions in the study area is minimal with the majority maintaining or improving conditions experienced in the Do-Minimum Scenario.

5.9.5 The Football Stadium Sensitivity Test has shown that the local and wider highway network is expected to suffer from significant unmet demand should the Football stadium be introduced to the Embankment. Package 2 copes with the Stadium demand better than Package 1, but there is still a clear deterioration in performance of the package.

6. Economic Assessment

6.1 Introduction

6.1.1 This section sets out the economic assessment for Package 1 and Package 2 to provide a comparison of the value for money of each.

6.1.2 The scheme appraisal focuses on the aspects of scheme performance that are relevant to the nature of the intervention. These impacts are not limited to those directly impacting on the economy or those which can be monetised.

6.1.3 Economic assessment undertaken to date has considered the DfT's TAG guidelines, with specific reference to the following documentation:

- TAG Unit A1.1 – Cost-benefit analysis (July 2021)
- TAG Unit A1.2 – Scheme Costs (July 2021)
- TAG Unit A1.3 – User and Provider impacts (July 2021)
- TAG Unit M3.1 – Highway Assignment Modelling (May 2020)
- TAG Unit M4 – Forecasting and Uncertainty (May 2019).

6.1.4 These units are the latest TAG Guidance released by the Department for Transport

6.2 Approach to Appraisal

6.2.1 The Economic Case for the schemes is focused on the following aspects;

- Assessing the monetised direct, localised, and economic efficiency benefits of the scheme
- Offsetting identified benefits against the scheme costs to provide a Benefit to Cost Ratio (BCR).

6.2.2 The PTM3 model has been used to test the package of options. Model outputs, along with scheme costs, have been assessed in DfT's Transport User Benefits Appraisal (TUBA version 1.9.15) tool to calculate a package Benefit to Cost Ratio (BCR).

6.2.3 The SATURN-based highway model includes forecast years of 2026, 2031, and 2036, which have been used to appraise impacts of the core scenario. These modelled forecast years have been used in the current TUBA economic appraisal.

6.2.4 Travel demands are consistent between the Do Minimum and Do Something scenarios, for each forecast year. The model demonstrates that the packages of schemes will reduce congestion, leading to less delay and travel time.

6.2.5 Full details relating to the calibration and validation of the model can be found in the Local Model Validation Report (LMVR). Details about the forecasting procedure can be found in the Forecasting Report, but it should be noted that the latest forecasts in relation to the University differ from those in the original PTM3 forecasting report due to recent changes to planning assumptions. This assessment is based on the most recent information.

6.2.6 The model output files were then entered into TUBA software to undertake the Economic Assessment and calculate a BCR. The annualisation factors shown in Table 6.1 below were specified within TUBA to calculate the likely annual transport user benefits for the AM, Inter, and PM peak hours and have been derived from nearby Highways England WebTRIS data. It was found that the 16:00 – 17:00 hour flows closely resembled the total flows observed within the PM peak hour. AM, PM and Inter-peak annualisation factors have therefore been calculated that convert the single peak hour demand to annual peak period demand.

Table 6.1 Annualisation Factors

Time Slice	Duration (min)	Annualisation Factor	Period	Description
1	60	245	1	Convert from 08:00 – 09:00 to annual 08:00 – 09:00 period
2	60	525	2	Convert from 17:00 – 18:00 to annual 16:00 – 18:00 period
3	60	1,518	3	Convert from 14:00 – 15:00 to annual 10:00 – 16:00 period

6.2.7 A proportionate approach focused on transport user benefits (Transport Economic efficiency; TEE) has been undertaken to demonstrate value for money from the preferred package of schemes.

6.2.8 The Economic Assessment has been undertaken for a 60-year assessment period (2021 to 2080).

6.3 Economic Assessment: Package 1

Present Value Costs

6.3.1 A scheme cost estimate has been produced for Package 1. The Base Investment Cost and Risk Adjusted Base Investment costs are detailed in Table 6.2 below. The cost is the capital cost in current year (2021) prices required to construct the scheme. A risk allowance has been applied on a scheme-by-scheme basis and varies between 16% and 24% (with 10% allowed applied to further design and business case development work). Adjustment to 2010 Market Prices has been and 3.72% inflation has also been applied.

Table 6.2 Package 1 Risk Adjusted Base Cost (2021 prices)

Package 1	Scheme / Component	Base Investment Cost (No Risk)	Risk Allowance	Risk Adjusted Base Cost
1.1	New A1139 NB Off-slip onto Bishops Road (Junction 4a)	£ 5,023,589	£ 1,186,335	£ 6,209,924
1.2	Junction 38 Improvements	£ 456,909	£ 75,861	£ 532,770
1.3	Fengate / Boongate Junction Improvements	£ 771,849	£ 140,768	£ 912,618
1.4	Junction 5 Improvements	£ 676,189	£ 134,321	£ 810,510
1.6	Wellington Street Improvements	£ 455,992	£ 74,136	£ 530,128
1.7	Junction 39 Improvements	£ 679,948	£ 146,720	£ 826,669
1.8	Sustainable Transport Improvements	£ 1,318,559	£ 263,712	£ 1,582,271
OBC	(Modelling, Business Case, Consultation, Stakeholder Engagement)	£ 200,000	£ 20,000	£ 220,000
FBC	(Modelling, Business Case, Consultation, Stakeholder Engagement)	£ 160,000	£ 16,000	£ 176,000
Total		**£ 9,743,036**	**£ 2,057,854**	**£ 11,800,890**

6.3.2 Optimism Bias has also been applied to the Risk Adjusted Base Cost for the construction of each scheme using a rate of 46% for roads and active travel improvements and 55% for structures in line with TAG unit A1.2 (July 2021)

6.3.3 The Economic Assessment has been undertaken for a 60-year assessment period (2021 to 2080).

6.3.4 An allowance of £100,000 has also been included for land purchase, relating to the Boongate / Fengate junction scheme. Any sunk costs have been excluded from the assessment.

6.3.5 A cost allowance has also been included for Sustainable Transport Improvements in the area. The benefits of these schemes are not included in the economic assessment at this stage and are expected to improve the package BCRs when incorporated as part of the Outline Business Case.

6.3.6 Note that the costs of Package 1 have increased since the SOBC as further survey and design work have identified higher construction costs associated with each of the schemes, including the requirement for an underpass beneath the new slip road.

Present Value Benefits

6.3.7 The transport benefits of the scheme were assessed using the SATURN-based PTM3 (built in v11.4.07H).

6.3.8 The difference between the DM and DS scenarios demonstrates the benefits of implementing the scheme. These benefits are measured using:

- Network assignment statistics
- Link flow changes
- Journey times
- Journey routing

6.3.9 The model output files were then entered into the TUBA software to undertake the Economic Assessment and calculate a BCR.

6.3.10 TUBA produces figures for a number of benefits, including Greenhouse Gases User benefits, and Indirect Taxation. Indirect Taxation often provides a negative benefit figure. This is a result of the reduced fuel being purchased as journeys become more efficient with the improvements. This in turn reduces the money the government receives in taxes.

6.3.11 This identifies the Present Value Benefits (PVB) to be **£3,729,000.** A breakdown of these benefits are shown in Table 6.3 beneath.

Benefit Cost Ratio

6.3.12 The Benefit Cost Ratio (BCR) is the ratio of PVB to PVC. Table 6.3 beneath summarises the BCR for the preferred scheme as calculated using TUBA.

Table 6.3 Package 1 Analysis of Monetised Costs and Benefits (AMCB)

Value (£,000s) 2010 prices, benefits discounted to 2010	
Benefits	
Greenhouse Gases	423
Consumer Users (Commuting)	-247
Consumer Users (Other)	4,054
Business Users/Providers	279
Indirect Taxes	-780
Present Value of Benefits (PVB)	3,729
Costs	
Broad Transport Budget	10,149
Present Value of Costs (PVC)	10,149
Net Benefit / BCR Impact	
Net Present Value (NPV)	-6,420
Benefit / Cost Ratio (BCR)	**0.367**

6.3.13 The DfT uses the following thresholds to determine the Value for Money statement associated with a BCR:

- Very Poor Value for Money if BCR = < 0.0
- Poor Value for Money if BCR = 0.0 to 1.0
- Low Value for Money if BCR = 1.0 to 1.5
- Medium Value for Money if BCR = 1.5 to 2.0
- High Value for Money if BCR = 2.0 to 4.0
- Very High Value for Money if BCR > 4.0

6.3.14 Based on transport user benefits alone, this scheme will provide **Poor Value for Money**.

6.3.15 The BCR reported for this Package in the SOBC was 5.223. The BCR is now significantly lower for two reasons, the first of which is the increase in the scheme cost estimate based on more recent and thorough design work, and the second is a significant change in the University Planning assumptions, which has reallocated the University parking from the Embankment Area to Wellington Street. This has significantly degraded the Package 1 BCR as many of the benefits associated with the new slip road delivering high volumes of traffic close to the parking are lost, and vehicles using the slip road now need to pass through the busy City Centre to reach the new parking destination.

6.4 Spread of Benefits

6.4.1 The TUBA results include a detailed breakdown of the scheme benefits including (but not limited to) benefits by time saving and benefits by distance. These benefits are broken down by vehicle type and journey purpose to better understand how different user types will benefit from the scheme. Table 6.4 below shows the time benefits saving by vehicle type.

Table 6.4: Package 1 Non-Monetised Time Benefits by Time Saving

Non-Monetised Time Benefits By Time Saving							
Time benefits (thousands of person hrs) by size of time saving							
Vehicle Type	Purpose	< -5 mins	-5 to -2 mins	-2 to 0 mins	0 to 2 mins	2 to 5 mins	>5 mins
Car	Business	0	-18	-1241	1083	270	0
Car	Commuting	0	-85	-2812	2190	554	0
Car	Other	2	-205	-17404	15988	2968	2
LGV Freight	Business	0	-72	-1867	1525	487	3
LGV Freight	Commuting	0	0	0	0	0	0
LGV Freight	Other	0	0	0	0	0	0
OGV1	Business	-4	-27	-867	599	102	10
OGV1	Commuting	0	0	0	0	0	0
OGV1	Other	0	0	0	0	0	0

6.4.2 Table 6.4 shows that car users experience the greatest time benefit from the implementation of Package 1. Within the car users, the 'other' journey purpose experiences the greatest impact, which is correlates with the composition of trip types across the model.

6.4.3 Table 6.5 below shows the journey time benefits by distance.

Table 6.5: Package 1 Non-Monetised Time Benefits by Distance

Non-Monetised Time Benefits By Distance									
Time benefits (thousands of person hrs) by distance									
Vehicle Type	Purpose	< 1 kms	1 to 5 kms	5 to 10 kms	10 to 25 kms	25 to 50 kms	50 to 100 kms	100 to 200 kms	>200 kms
Car	Business	-2	220	74	-114	-36	-22	-19	-8
Car	Commuting	-10	312	150	-429	-89	-61	-16	-11
Car	Other	28	3548	-20	-1413	-238	60	-387	-231
LGV Freight	Business	-2	178	176	-189	-38	6	-30	-26
LGV Freight	Commuting	0	0	0	0	0	0	0	0
LGV Freight	Other	0	0	0	0	0	0	0	0
OGV1	Business	0	14	35	10	-29	-55	-122	-41
OGV1	Commuting	0	0	0	0	0	0	0	0
OGV1	Other	0	0	0	0	0	0	0	0

6.4.4 The table shows that those making trips of between 1km - 5kms benefit most from the proposed package. As with the time savings, car users experience the greatest level of benefit, and these apply mostly to those who travel for 'other' purposes.

6.5 Economic Assessment: Package 2

Present Value Costs

6.5.1 A scheme cost estimate has been produced for Package 2, following the same method as Package 1 above. The costs Based Investment Cost and Risk Adjusted Base Investment costs are detailed in Table 6.6 below.

Table 6.6 Package 2 Risk Adjusted Base Cost (2021 prices)

Package 2	Scheme / Component	Base Investment Cost (No Risk)	Risk Allowance	Risk Adjusted Base Cost
2.1	Boongate Dualling	£ 9,147,086	£ 2,171,251	£ 11,318,337
2.2	Junction 38 Improvements	£ 447,375	£ 75,861	£ 523,237
2.3	Fengate / Boongate Junction Improvements	£ 759,484	£ 140,768	£ 900,252
2.4	Junction 5 Improvements	£ 661,275	£ 134,321	£ 795,596
2.6	Wellington Street Improvements	£ 444,854	£ 74,136	£ 518,990
2.7	Junction 39 Improvements	£ 668,810	£ 146,720	£ 815,530
2.8	Sustainable Transport Improvements	£ 1,302,886	£ 263,712	£ 1,566,598
OBC	(Modelling, Business Case, Consultation, Stakeholder Engagement)	£ 200,000	£ 20,000	£ 220,000
FBC	Full Business Case	£ 160,000	£ 16,000	£ 176,000
Total		**£ 13,791,770**	**£ 3,042,770**	**£ 16,834,539**

6.5.2 Again, a risk allowance has been applied on a scheme-by-scheme basis and varies between 16% and 24% (with 10% allowed applied to further design and business case development work).

6.5.3 Optimism Bias has also been applied to the Risk Adjusted Base Cost for the construction of each scheme using a rate of 46% for roads and active travel improvements and 55% for structures in line with TAG unit A1.2 (July 2021).

6.5.4 An allowance of £100,000 has also been included for land purchase, relating to the Boongate / Fengate junction scheme. Any sunk costs have been excluded from the assessment.

6.5.5 A cost allowance has also been included for Sustainable Transport Improvements in the area. The benefits of these schemes are not included in the economic assessment at this stage and are expected to improve the package BCRs when incorporated as part of the Outline Business Case.

Present Value Benefits

6.5.6 Following the same method as Package 1 above, the Present Value Benefits (PVB) for this package has been identified as **£34,742,000.** A breakdown of these benefits is shown in Table 6.7 beneath.

Benefit Cost Ratio

6.5.7 The Benefit Cost Ratio (BCR) is the ratio of PVB to PVC. TABLE beneath summarises the BCR for the preferred scheme as calculated using TUBA.

Table 6.7 Package 2 Analysis of Monetised Costs and Benefits (AMCB)

Value (£,000s) 2010 prices, benefits discounted to 2010	
Benefits	
Greenhouse Gases	412
Consumer Users (Commuting)	7,656
Consumer Users (Other)	18,909
Business Users/Providers	8,578
Indirect Taxes	-813
Present Value of Benefits (PVB)	34,742
Costs	
Broad Transport Budget	14,409
Present Value of Costs (PVC)	14,409
Net Benefit / BCR Impact	
Net Present Value (NPV)	20,333
Benefit / Cost Ratio (BCR)	**2.411**

6.5.8 The DfT uses the following thresholds to determine the Value for Money statement associated with a BCR:

- Very Poor Value for Money if BCR = < 0.0
- Poor Value for Money if BCR = 0.0 to 1.0
- Low Value for Money if BCR = 1.0 to 1.5
- Medium Value for Money if BCR = 1.5 to 2.0
- High Value for Money if BCR = 2.0 to 4.0
- Very High Value for Money if BCR > 4.0

6.5.9 Based on transport user benefits alone, this scheme will provide **High Value for Money**.

6.5.10 This BCR represents an increase from the BCR reported in the SOBC, which was 1.574. Although the costs have remained relatively stable for Package 2 since the last stage of assessment, the change in assumption associated with the University Parking means that there is now significantly more benefit associated with dualling Boongate which provides a high-capacity link from the City Centre directly to Wellington Street and much of the Embankment Area parking provision.

6.6 Spread of Benefits

6.6.1 The TUBA results include a detailed breakdown of the scheme benefits including (but not limited to) benefits by time saving and benefits by distance. These benefits are broken down by vehicle type and journey purpose to better understand how different user types will benefit from the scheme. Table 6.8 below shows the time benefits saving by vehicle type.

Table 6.8: Package 2 Non-Monetised Time Benefits by Time Saving

Non-Monetised Time Benefits By Time Saving							
Time benefits (thousands of person hrs) by size of time saving							
Vehicle Type	Purpose	< -5 mins	-5 to -2 mins	-2 to 0 mins	0 to 2 mins	2 to 5 mins	>5 mins
Car	Business	0	-5	-551	1138	51	71
Car	Commuting	0	-9	-1249	2539	264	214
Car	Other	0	-44	-7830	14184	1351	1799
LGV Freight	Business	0	-19	-835	1464	114	20
LGV Freight	Commuting	0	0	0	0	0	0
LGV Freight	Other	0	0	0	0	0	0
OGV1	Business	-2	-12	-405	526	27	11
OGV1	Commuting	0	0	0	0	0	0
OGV1	Other	0	0	0	0	0	0

6.6.2 Table 6.8 shows that car users experience the greatest time benefit from the implementation of Package 1. Within the car users, the 'other' journey purpose experiences the greatest impact, which is correlates with the composition of trip types across the model.

6.6.3 Table 6.9 below shows the journey time benefits by distance.

Table 6.9: Package 2 Non-Monetised Time Benefits by Distance

Non-Monetised Time Benefits By Distance									
Time benefits (thousands of person hrs) by distance									
Vehicle Type	Purpose	< 1 kms	1 to 5 kms	5 to 10 kms	10 to 25 kms	25 to 50 kms	50 to 100 kms	100 to 200 kms	>200 kms
Car	Business	6	244	252	136	37	30	2	-2
Car	Commuting	14	425	661	402	156	91	14	-5
Car	Other	122	3473	2202	1479	817	1156	295	-85
LGV Freight	Business	2	139	275	197	82	55	3	-7
LGV Freight	Commuting	0	0	0	0	0	0	0	0
LGV Freight	Other	0	0	0	0	0	0	0	0
OGV1	Business	0	11	50	39	24	31	4	-15
OGV1	Commuting	0	0	0	0	0	0	0	0
OGV1	Other	0	0	0	0	0	0	0	0

6.6.4 The table shows that those making trips of between 1km - 5kms benefit most from the proposed package. As with the time savings, car users experience the greatest level of benefit, and these apply mostly to those who travel for 'other' purposes.

6.7 Economic Assessment Results

6.7.1 The results of the economic assessment are compared in Table 6.10 below.

Table 6.10 Economic Assessment AMCB Comparison

Value (£,000s) 2010 prices, benefits discounted to 2010	Package 1	Package 2
Benefits		
Greenhouse Gases	423	412
Consumer Users (Commuting)	-247	7,656
Consumer Users (Other)	4,054	18,909
Business Users/Providers	279	8,578
Indirect Taxes	-780	-813
Present Value of Benefits (PVB)	3,729	34,742
Costs		
Broad Transport Budget	10,149	14,409
Present Value of Costs (PVC)	10,149	14,409
Net Benefit / BCR Impact		
Net Present Value (NPV)	-6,420	20,333
Benefit / Cost Ratio (BCR)	**0.367**	**2.411**
Value for Money Statement	Poor	High

6.7.2 As referenced above, it should be noted that in the SOBC assessment, Package 1 outperformed Package 2. This is as a result of changes to modelling assumptions, that have come about either due to design changes or new information regarding parking provision. Most significantly, the assumption that Wellington Street Car Park will accommodate many of the future trips drastically affects the benefits that Package 1 provides, whilst Package 2 is well placed to accommodate these trips. The estimated cost of Package 1 has also increased since the SOBC based on more mature design information.

6.7.3 The Economic Assessment has demonstrated that Package 2 provides a much greater Benefit to Cost Ratio than Package 1.

6.8 Mode Shift

6.8.1 The SOBC did not include any benefits arising from modal shift. The was due to the scheme being predominantly a highway improvements scheme with the objective of relieving peak-time congestion and delay at Junction 5 on the A1139 Frank Perkins Parkway, and other local routes within the study area. There are walking and cycling improvements proposed as part of the improvement scheme, however these are not expected to stimulate significant modal shift. Mode Shift benefits will be reconsidered within the OBC for the preferred Package.

7. Public Engagement

Introduction

7.1.1 In October 2020, Peterborough City Council was awarded £22.9m from the Government's Towns Fund. One of the key components of the Towns Fund is 'Riverside Development and Connections' which includes creating a masterplan for the Embankment.

7.1.2 During November 2021, the City Council undertook a public engagement exercise on four different masterplan options for the Embankment. Each option comprises different land-use scenarios.

7.1.3 The public engagement exercise included a in-person open day on the 20th November 2021 and a public webinar on the 22nd November 2021. At both events, plans of both Package 1 and Package 2 were presented.

7.1.4 General feedback on the four masterplan options was received at the two events as well as via an on-line questionnaire up until 5th December 2021.

Feedback

7.1.5 Seven comments relating to transport were received from the public engagement exercise, although the majority of feedback was not directly linked to Package 1 or Package 2, with more general comments around parking and connectivity.

7.1.6 Parking was raised in five of the seven comments, particularly with regard to the possibility of the Peterborough United Football Ground relocating to the Embankment.

7.1.7 Connectivity to the Embankment was raised in three of the seven comments.

7.1.8 The response form Peterborough Civic Society discussed Package 1 and Package 2 and stated that a '*slip road from the northbound Frank Perkins Parkway to Bishops Road would bring large volumes of traffic to an already congested area with no significant parking available for them*'. They also identified that the *'slip road could be used by motorists trying to access the city centre via what is perceived to be a short cut, so bringing a lot more congestion to Bishops Road'*.

7.1.9 Peterborough Civic Society perceived the *'dualling of Boongate and use of the large Wellington Street Car Park would be a more practical solution but some would find the 800m walk to the Embankment too far*'.

Summary of Public Engagement

7.1.10 The public engagement exercise highlighted that public concerns relating to the Embankment Masterplan and transport were focussed on parking and connectivity.

7.1.11 The active travel proposals as part of both Package 1 and Package 2 will assist in improving access to and from the Embankment, particularly along Vineyard Road / St John's Street to Wellington Street Car Park.

7.1.12 The Peterborough Civic Society response made reference to each of the Packages, and stated that the dualling of Boongate (Package 2) and use of Wellington Street Car Park is a more practical solution. However, no further analysis can be undertaken on which package is preferred due to the low number of responses.

7.1.13 A further public consultation exercise will be undertaken when the pre-liminary design of the preferred Package is complete, to enable comments to be considered for the detailed design.

8. Identification of Preferred Option

8.1.1 The purpose of the Package Assessment Report is to summarise the further assessment undertaken on both packages, including a review of policy, design and construction, environment and operational and economic performance, and identify a preferred Package.

8.1.2 The University Access Study Strategic Outline Business Case (SOBC) identified two packages of schemes to add capacity to the highway network and address the existing problems of peak hour congestion and delay at key junctions within the study area. Additionally, they will help facilitate development at the Embankment Area and across the wider City Centre area.

8.1.3 The key difference between the two packages of schemes is that Package 1 provides a new northbound off-slip (Junction 4a) between A1139 Frank Perkins Parkway and Bishops Road. Package 2 includes the dualling of Boongate between Junction 5 (A1139 Frank Perkins Parkway / Boongate) and Junction 39 (Crawthorne Road / Eastfield Road / Boongate / St John's Street / New Road)

8.1.4 A preferred Package could not be determined at the SOBC stage due to ongoing planning and regeneration discussions. Concerns were raised with Package 1 and the operational performance of the highway network directly adjacent to the proposed northbound off-slip as identified in the Strategic Modelling. In addition, as the SOBC programme was drawing to a close, there were changes to a number of the planning assumptions in the study area. The changes included a significant increase in the number of students for the latter phases of the University planning application, and the possibility of the Peterborough United Football Ground relocating to the Embankment.

8.1.5 Due to the pace of developments within the study area, a more detailed assessment of the two packages across a range of areas was needed to identify a preferred option. This report documents that further assessment.

8.1.6 Each assessment is discussed in turn below.

Strategic Fit Assessment

8.1.7 The Strategic Fit Chapter set out a comparison of how well Package 1 and Package 2 fit with local policy and regenerations proposals, including the Local Transport Plan, City Centre Transport Vision and Embankment Masterplan. Package 2 demonstrated a very good strategic fit.

8.1.8 The dualling of Boongate, provided as part of Package 2, provides a high-capacity and high-quality link from the Parkway Network to the transport hub at Wellington Street (which is expected to provide parking for the future growth of the Embankment Area) and significantly reduces the number of trips on the routes around the Embankment Area.

8.1.9 Package 2 also provides the chance to redevelop the area around Junction 39, creating significant opportunities to improve walking and cycling infrastructure, as well as public transport infrastructure.

8.1.10 Given the timing of development and pace of growth on the Embankment, delivery of Package 2 would likely form the first phase of implementation of the City Centre Transport Vision.

8.1.11 Package 1 did not demonstrate a good strategic fit; the new northbound off-slip delivers high volumes of traffic on to a low-capacity part of the network with limited scope for improvement, and does not work in conjunction with a Transport Hub at Wellington Street which has been confirmed since the SOBC was produced. Package 1 did not meet the ambition of the City Centre Transport Vision or the development objectives for the Embankment Area.

Design and Construction Assessment

8.1.12 Each improvement identified in Package 1 and Package was considered in terms of design constraints and potential construction issues. The assessment concluded that there are not considered to be any insurmountable design or construction challenges associated with either package.

8.1.13 Package 1 required no third-party land to construct the new off-slip. However, the provision of the new off-slip will impact the Bishop's Road recreation area, reducing its size. Construction of the new northbound off-slip is not considered to be difficult, as much of the slip-road can be built off-line with night-time or weekend closures used for tie-ins at either end.

8.1.14 The concept design has tried to minimise the impact on the Corsican Elms through realignment of the road, with only two trees requiring removal. Four other trees (of different species) will also need to be removed on the southern side of the recreation area.

8.1.15 The land required to construct the Boongate Dualling is within the highway boundary or Community Related Asset (CRA) land which is controlled by the Council. The dualling of Boongate will impact the current turning head on Dickens Street which will require relocation Several parking spaces on Dickens Street may be lost to this relocation, as well as a portion of the tree and shrub belt, requiring complimentary landscaping works to offset the impact

8.1.16 Construction of this scheme can predominantly be undertaken off-line, with no disruption to the existing network. Consideration will need to be given on how best to minimise disruption to a key route into the City Centre from the Parkway Network, and what impacts and constraints are associated with night-time working in an urban area close to residential areas.

Environmental Assessment

8.1.17 The environmental assessment focused on the significant new pieces of infrastructure in each package: the new northbound off-slip (Junction 4a) in Package 1; and the dualling of Boongate in Package 2 to assist with determining the preferred option from an environmental perspective.

8.1.18 An environmental appraisal was completed for each of the following areas:

- Air Quality
- Archaeology and Cultural Heritage
- Landscape and Visual
- Biodiversity
- Noise and Vibration
- Water: Hydrology and Drainage
- Socio Economic and Community Impacts
- Socials and Geology

8.1.19 The overall environmental assessment of the northbound off-slip (Package 1) is Amber and for Boongate Dualling (Package 2) is Amber/Green. This is based on the assumption that appropriate mitigation would be included as part of the Scheme design and construction methodology and would be fully developed as the either scheme progresses. It is a preliminary assessment and further environmental assessments will be undertaken as the design progresses.

8.1.20 The environmental assessment identified a number of additional constraints for the northbound off-slip when compared to Boongate Dualling and present a greater risk to delivery.

8.1.21 The northbound off-slip is situated upon recreational urban green land and should be noted as a potential higher risk to the delivery of the scheme. It also has the potential to impact the setting of high value a heritage asset (Peterborough Cathedral).

8.1.22 Boongate Dualling will require removal of a favourable habitat for protected species comprising trees, tall ruderals, wildflowers, and scrub. However appropriate mitigation can be designed in to offset this.

Operational Assessment Summary

8.1.23 The Operational Assessment has shown that Package 2 performs better than Package 1 based on the Model Summary Statistics, Subpath analysis and LOS results.

8.1.24 Bishop's Road is a low-capacity road with residential properties along its northern edge. The additional demand on Bishop's Road in Package 1 causes gridlock on the adjacent highway network with vehicles travelling westbound on Bishop's Road and Fengate, and northbound on Vineyard Road experiencing severe delays. The queuing and delay on these routes causes a significant amount of traffic to re-route along Star Road to avoid these delays. Star Road already has traffic calming and any increase in vehicles on this route is likely to be unacceptable. There are limited options to increase the capacity of Bishop's Road or Vineyard Road without significantly changing the nature of the road.

8.1.25 The queuing and delay along Bishop's Road have a knock-on impact to the new northbound off-slip which also suffers from severe queues, extending back to the A1139 Frank Perkins Parkway.

8.1.26 Package 2 provides a high-quality, high-capacity direct route from the A1139 Frank Perkins Parkway to Wellington Street Car Park. Overall Package 2 operates effectively in both the AM and PM Peak Hours. The impact on queuing and delay on the approaches to the junctions in the study area is minimal with the majority maintaining or improving conditions experienced in the Do-Minimum Scenario.

8.1.27 The Football Stadium Sensitivity Test has shown that the local and wider highway network is expected to suffer from significant unmet demand should the Football stadium be introduced to the Embankment. Package 2 copes with the Stadium demand better than Package 1, but there is still a clear deterioration in performance of the package.

Economic Assessment Summary

8.1.28 An Economic Assessment was undertaken on both packages using updated cost information provided by the latest design phase and incorporating the latest assumptions from the University Planning Application.

8.1.29 The Economic Assessment has demonstrated that Package 2 provides a much greater Benefit to Cost Ratio than Package 1.

8.1.30 The results reverse the results from the assessment at SOBC, when Package 1 achieved a much higher value for money than Package 2. This is as a result of changes to modelling assumptions, that have come about either due to design changes or new information regarding parking provision. Most significantly, the assumption that Wellington Street Car Park will accommodate many of the future trips drastically affects the benefits that Package 1 provides, whilst Package 2 is well placed to accommodate these trips. The estimated cost of Package 1 has also increased since the SOBC based on more mature design information.

Identification of Preferred Option

8.1.31 Each of the assessments discussed above has identified a preferred option. Table 8.1 summarises the preferred option identified in each assessment area.

Table 8.1: Summary of Preferred Option by Assessment Area

Assessment Area	Preferred Package
Strategic Fit Assessment	Package 2
Design and Construction Assessment	No preferred package
Environmental Assessment	Package 2
Operational Assessment	Package 2
Economic Assessment	Package 2
Public Engagement	No preferred package

8.1.32 It is clear from each of the assessments undertaken, that Package 2 is the better performing option and therefore will be taken forward to Preliminary Design and Outline Business Case as the preferred option.

8.1.33 Package 2 has a strong policy fit, especially with regards to the objectives of the City Centre Transport Vision. Package 2 provides a high-capacity, high-quality link from the A1139 Frank Perkins Parkway to the transport hub at Wellington Street (which is expected to provide parking for the future growth of the Embankment Area). The operational assessment demonstrated that Package 2 provides significant improvements to junctions to accommodate the additional traffic without causing significant queueing on low-capacity roads and rat-running on routes within the study area.

8.1.34 Package 2 also creates the opportunity to drastically redevelop the area around Junction 39, creating significant opportunities to improve walking and cycling infrastructure, as well as public transport infrastructure.

8.1.35 Given the timing of development and pace of growth on the Embankment, delivery of Package 2 would likely form the first phase of implementation of the City Centre Transport Vision.

Next Steps

8.1.36 Subject to acceptance of this Package Assessment Report and its recommendation to proceed with Package 2, the next stage of scheme development is to undertake the Preliminary Design of all the schemes included within Package 2, including all supporting tasks such as site surveys, environmental assessments, and stakeholder engagement. This phase of work will then culminate with an Outline Business Case (OBC) that will be submitted to the CPCA for review and approval. The next phase of work is expected to begin in April 2022 and is expected to last until July 2023. Funding to progress the Preliminary Design and OBC needs to be secured to enable this work to progress.

Appendices

Appendix A: Concept Design Drawings

Appendix B: Environmental Assessment Report